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JOHNSON (J.). **Fusarium-wilt of Tobacco.**—*Journ. Agric. Res.*, XX, 7, pp. 515–535, 5 pl., 1 fig., 1921.

The author observed a typical wilt disease of tobacco in Maryland in 1916. A similar disease occurred in Ohio in 1919, and it is possible that it will be found elsewhere as it is liable to be confused with the 'Granville' tobacco wilt caused by *Bacillus solanacearum*. The tobacco wilts associated with *Fusarium* recorded from the Cape of Good Hope and Ceylon, and the tobacco disease attributed to *Fusarium tabacivorum* Delacroix in France are regarded as doubtful in origin.

The present disease is characterized by a yellowing and wilting of the leaves of the plant, usually followed by death. The fibro-vascular system is turned brown or black. Under field conditions the attack may appear at any stage in the growth of the plants, but it is probable that it usually begins when they are young and remains latent unless conditions are favourable for further development. In contrast to the 'Granville' wilt the vascular lesions are distinctly dry. There is no rotting of the living parenchyma, the parasite being a typical vascular one. Death is believed to result not so much from clogging of the vessels as from toxic substances formed by the parasite or formed by the action of the parasite on the host.

A *Fusarium*, closely related to *F. oxysporum* (Schlect.) Wr. and regarded as a variety (var. *nicotianae* John. n. var.) of this species, was regularly present in the affected tissues, and was readily isolated. Infection was secured with pure cultures through the soil, and was greatly enhanced by wounding below the surface of the soil. Wounds in the stalk above ground do not seem to permit successful infection. A relatively high soil temperature (28° to 31° C.) was found to favour infection, but there is a wide range of temperature through which the disease can occur. An acid soil was also found to favour the disease. High soil moisture is not regarded as assisting infection, and the Maryland attack was on high, sandy land.

The susceptibility of the varieties of tobacco tested differs con-

siderably. None tried was absolutely immune, but Connecticut Havana, Cuban, and Sumatra showed 98 per cent. resistance, while Pennsylvania Broadleaf and Wisconsin binder selection H 12074 were nearly as good. The least resistant was the ordinary White Burley amongst the *N. tabacum* varieties, though *N. glauca* was still more susceptible. A strain of White Burley that had been selected for resistance to *Thielavia basicola* was also found to be markedly resistant to the wilt, and this indicates that, should the disease become severe, selection amongst the susceptible commercial varieties may be entirely feasible.

The morphology and cultural characters of the organism are described in detail. Infection has been secured with two strains of *F. oxysporum* from potato on tobacco, but attempts to infect potatoes with the fungus from tobacco failed. The latter retained its virulence on its proper host unimpaired after four years in culture.

SMITH (E. F.) & MCKENNEY (R. E. B.). **The present status of the Tobacco blue-mold (Peronospora) in the Georgia-Florida district.**—*U.S. Dept. of Agric. Circ.* 181, 2 pp., 1921.

The statement that the Georgia-Florida industry has been destroyed by blue-mould disease [see this *Review*, i, 9, p. 320] is without foundation. The infection in the seed-beds was very severe, but growing conditions were favourable to the development of the crop and adverse to the spread of the disease. The attacks were therefore substantially confined to the lower leaves, and are estimated not to exceed 5 per cent. of the crop in the infected areas, i. e. an average of about one leaf per plant. The hot dry period during the first ten days of May appears to have been instrumental in checking further development of the disease.

Equally baseless are the statements to the effect that the disease will spread on tobacco in storage, and that even leaves maturing without visible infection are unsuitable for use. The infection does not spread on harvested and cured tobacco, and clean leaves are in all respects adapted for wrapping purposes.

The use of the term 'mould' in connexion with this fungus is somewhat misleading unless properly qualified, *Peronospora* having nothing in common either with the ordinary green or white mildew of damp weather or with the white mould of cigar tobacco.

The disease has not appeared in Connecticut, North Carolina, southern Alabama, or the Madison or Dade City districts of Florida.

BURGER (O. F.) & PARHAM (H. C.). **Peronospora disease of Tobacco.**—*Quart. Bull. State Plant Board Florida*, v, 4, pp. 163–167, 1 fig., 1921.

The authors are not inclined to believe that this [see preceding abstract and this *Review*, i, 9, p, 320] is a recently introduced disease, its simultaneous appearance under the favourable weather conditions of the spring of 1921 in every seed-bed in Gadsden County, even those that were isolated and not exposed to outside infection, suggesting that it must have been present throughout in previous years. Tobacco grown under 'combination shade' made

of slats and cheese cloth was the most severely attacked, then that grown under slats only, while there was little in the sun-grown crop, and artificial infections failed once the weather became hot. Of late years more shade-grown tobacco is planted, and sowing is done earlier while the weather is still cool. These conditions are believed to be largely responsible for the present outbreak. The disease was so completely checked by the hot weather in May and June that the damage is only estimated at about 1 per cent. of the season's crop. It is believed that the disease may be controlled by spraying the seed-beds with 2–2–50 Bordeaux mixture.

PRITCHARD (F. J.) & PORTE (W. S.). **Effect of fertilizers and lime on control of Tomato leaf spot (Septoria lycopersici).**—*Phytopath.*, xi, 11, pp. 433–441, 16 figs., 1921.

After an introductory review dealing with current interpretations of fertilizer effects on disease resistance, a series of experiments to test the behaviour of the tomato leaf spot fungus (*Septoria lycopersici*) with different substances is described. The plants, of which there were twenty-five in each group, were grown in pots or glass jars in fertile, friable loam soil. Sodium nitrate (15·65 per cent. N), potassium sulphate (48 per cent. K_2O), acid phosphate (16 per cent. available P_2O_5), and lime were used in varying quantities with and without other fertilizer ingredients. Copper sulphate was also used in two sets of experiments. The plants were inoculated with *Septoria lycopersici*, kept in a moist chamber for 48 to 60 hours, and then transferred to greenhouse benches. The initial infections were counted the eleventh day after inoculation. The records included measurement of average leaf area on the plants, number of infections per plant, and number of infections per unit area of leaf surface. The treated plants received the nitrate, phosphate, or potash at the rates of 50, 150, 300, and 500 parts per million parts of soil, lime at 200, 400, and 1,000, and copper sulphate at 5, 10, and 40 parts per million parts of soil. The controls received either no fertilizer or uniform quantities of certain fertilizers which were also used for the treated plants.

Nitrate increased both the leaf area and the number of infections per plant, the former by 77 per cent. and the latter by 55 per cent. There was a reduction of 13 per cent. in the number of infections per square inch of leaf surface.

Acid phosphate increased the leaf area and number of infections per plant in three sets of experiments and decreased them in another. The average increase in these experiments was 14 per cent. for the leaf area and 50 per cent. for the number of infections per plant, while there was an increase of 32 per cent. in the number of infections per square inch of the leaf surface.

Lime reduced the leaf area by 2 per cent. and the number of infections per plant by 8 per cent., giving also a reduction of 7 per cent. in the number of infections per square inch of the leaf surface.

Potash gave conflicting results in two separate experiments. In the first there was a reduction of 19 per cent. in the leaf area, of 46 per cent. in the number of infections per plant, and of 33 per cent. in the number of infections per square inch of leaf surface.

In the second there was an increase of 6 per cent. in the leaf area, 77 per cent. in the number of infections per plant, and 68 per cent. in the number of infections per square inch of leaf surface.

Copper sulphate reduced the leaf area by 20 per cent., and the number of infections by 17 per cent., but the number of infections per square inch of leaf surface was increased by 4 per cent.

The results of the experiments indicate that the fertilizers only indirectly influenced the susceptibility to leaf spot through their effects on growth or the internal conditions accompanying development. This was true also of the different ratios and quantities used. The enlargement of the leaf area was correlated with an increase in the number of infections per unit area of the leaf surface. Favourable conditions for growth therefore increased susceptibility, while unfavourable conditions decreased it. Owing to the ideal conditions for infection, the percentage of disease was much higher than would normally be the case.

Truog and Meacham (*Soil Science*. vii, 1919) found that high acidity (hydrogen-ion concentration) of the cell sap often restricts the growth of plants, while the latter is promoted by a lower acidity, and it might, therefore, be assumed that the relationship between growth and infection really corresponds to that between acidity and resistance. Haas (*Bot. Gaz.*, lxiii, 1917), however, has shown that the total undissociated and dissociated acidity of plant cells is usually much greater than the dissociated acidity (hydrogen-ion concentration). It would seem, then, that the neutralization of acid in the cell by lime or other substances would have very little effect on the hydrogen-ion concentration since immediate dissociation would follow precipitation of the free acid. If, however, the dissociation of acids in plant cells is not so rapid a process as is assumed, hydrogen-ion concentration may have an important bearing on susceptibility to disease. Though probably not the plant's sole means of defence against parasites, it may be comparable to the serum of the blood in preventing animal disease.

Fertilizers apparently affect the susceptibility of plants to disease in the same general direction as they affect growth and they may, therefore, be used in such a way as to avoid conditions favourable for excessive infection, but they do not seem to provide a sufficient means for the control of tomato leaf spot.

JIVANNA RAO (P. S.). **The physiological anatomy of the spiked leaf in Sandal (Santalum album L.).**—*Indian Forester*, xlvii, 9, pp. 351–360, 2 pl., 1921.

In a previous article ('The cause of spike in Sandal', *ibid.*, xlvi, 9, pp. 469–487, 1920) the writer expressed the view that spike is due to an insufficient supply of water to the plant owing to relations with unfavourable hosts. The present investigation is confined to the starch content of the leaf of sandal, as the accumulation of starch constitutes the most essential feature of spike. The distribution of starch in the mesophyll was carefully studied, attention also being paid to the enlargement of cells and their number in a definite area. Sections were taken in the same way from (1) the leaves of a normal plant, (2) leaves in an advanced stage of spike,

and (3) leaves of an apparently normal plant which suffered from drought owing to the removal or absence of hosts.

The internal structure of the spiked leaf reveals an interesting condition. The six to seven lines of mesophyll are packed so closely as to leave no air cavities towards the lower surface. In the young leaves the cells forming the sheath round the vascular bundles or their ultimate tracheidal ramifications are the first to be filled with starch. In older leaves this precipitation of starch is noticeable in the central cells throughout the cross-section of the leaf, and after extending to the lower mesophyll cells it is finally observed in the layer of cells beneath the upper epidermis. In the later stages the cells of the lower epidermis also become filled with starch.

From the examination of a large number of cases the following conclusions were drawn: (*a*) In the earlier stages of spike little or no starch is present in the younger leaves; (*b*) starch is present in all the leaves of the spike in the older stages; (*c*) starch disappears when the disease is so advanced that the plant is in a dying condition; (*d*) leaves from an absolutely unspiked plant sometimes contain a large supply of starch; (*e*) in all cases there is a progressive increase in the quantity of starch from the youngest to the oldest leaves remaining on the twig.

There is a low ash-content in spiked as compared with normal leaves. In its physiological anatomy the changes in the spiked tree are such as would be due to a reduced water-supply. The maximum deposit of starch in spiked leaves is round the vascular bundles, but it gradually extends to the periphery until the whole leaf is crammed. This centrifugal increase of starch agrees with the view that the sugar concentration in leaves is generally highest in the palisade layer, producing the maximum osmotic pressure at this point, a downward gradient being apparent from the epidermis to the vascular bundles.

In the spiked twigs of sandal the medullary cells are among the first to form starch, the vascular sheaths next, and the palisade cells last. Measurements of the leaf-cells from cross-sections of normal and spiked leaves in the later stages reveal no appreciable difference in size, but their division is retarded owing to lack of full turgidity. The cause of spike must therefore be traced to those factors which limit the turgidity of the cells and thereby check their powers of growth.

Continuous and rapid growth is one of the striking characteristics of spiked twigs. Owing to the condensation of starch, the older leaves soon lose their maximum osmotic pressure, and turgidity, which is so intimately connected with growth, becomes greatest at the topmost point of the shoot. The scanty available water-supply is directed to the younger leaves until these repeat the process. It is interesting to note the tenacity of the plant under these conditions. Even when the trunk and branches are completely desiccated, the twigs continue to bear tufts of the smallest pigmented leaves, which die and fall off very quickly. An examination of these leaves showed that the cells were in a plasmolysed condition, there being only a few starch grains in the bundle sheaths. Evidently these

minute leaves receive an extremely low amount of moisture from the soil through the trunk and desiccated branches.

While agreeing in the main with the 'unbalanced circulation of sap' theory advanced by Hole (*ibid.*, xliii), the writer maintains that the difficulty of obtaining an adequate water-supply referred to above constitutes the primary cause of spike.

PETRAK (F.). **Mykologische Notizen, ii, 42. Über Septoria apii Chester.** [Mycological Notes, ii, 42. Notes on *Septoria apii* Chester.]—*Ann. Myc.*, xix, 1–2, pp. 31–32, 1921.

Septoria apii occurs in various forms, which differ greatly in the leaf spots they produce. The first—very rare—form is distinguished by having somewhat large, irregularly roundish, yellow-ochre or light brown spots, up to 5 mm. in diameter, with a raised circumference, the surrounding area being scarcely darker; these spots occur at considerable intervals from each other or even singly; they are either wholly sterile or else have a few pycnidia in the centre. Another form produces small, light yellow-ochre to brownish spots, 1 to 3 mm. in diameter, spread somewhat densely over the whole leaf surface and often so close together that they coalesce; they have raised edges and are either totally sterile or bear a few pycnidia on the upper or lower surface. In the third type the formation of true spots is absent, and the pycnidia appear on both surfaces of the leaf, at first in small, somewhat dense conglomerations which later spread gradually until the pycnidia seem to cover both surfaces of the leaf with their black dots, causing it to wither and dry up rapidly. This form also occurs on the leaf-stalks and stems of the host plant.

During the summer of 1920 the author grew in the open three varieties of knob-celery (celeriac), namely 'Erfurter frühester Markt', 'Riesen-Alabaster', and 'Prager Riesen'. The two last named were attacked by the *Septoria* directly after transplanting, and were so retarded in their development that by the autumn the resulting knobs hardly exceeded the size of a walnut. 'Erfurter frühester Markt', which was grown in the same bed as the other two, showed only a slight attack on a few leaves up to the middle of August, and it was not until the end of the month that infection became severe. Little damage was done at this late stage, and the harvest was excellent. The variety 'Prager Riesen' was attacked by the third form of the disease described above; 'Riesen-Alabaster' suffered in its early stages from the first, later from the second form; and 'Erfurter frühester Markt' was susceptible to the third form almost exclusively.

As preventive measures the author recommends that celery should be planted in beds which have been heavily manured in the previous season, and that a few weeks after transplanting sulphate of ammonia should be spread on the soil, an operation which can be repeated with advantage one month or six weeks later. It is also important to keep the beds watered during dry weather, as otherwise the fungus is liable to get the upper hand.

The author's attempts to inoculate parsley with *S. apii* failed.

JONES (L. R.) & DOOLITTLE (S. P.). **Angular leaf-spot of Cucumber.** —*Phytopath.*, xi, 7, p. 297, 1921.

Cucumber seed was planted at Ellison Bay, Wisconsin, in soil which, so far as known, had never before grown cucumbers. The seed used was from plants showing both mosaic and angular leaf spot (*Bacterium lachrymans*). No mosaic developed in the progeny, but angular leaf spot appeared on two plants in one hill, and spread over the half-acre field, the subsequent infection of the young fruit proving very serious. This supplements the previous observations of Carsner and of Gilbert and Gardner in showing that angular leaf spot can overwinter on the seed and is very destructive to the young fruit.

GARDNER (M. W.) & GILBERT (W. W.). **Field tests with Cucumber angular leaf-spot and anthracnose.**—*Phytopath.*, xi, 7, p. 298, 1921.

Field tests indicated that seed treatment with $HgCl_2$ (1–1,000 for five minutes) is effective as a control for angular leaf spot (*Bact. lachrymans*), although it does not eliminate all the infection. This treatment was also found to reduce anthracnose (*Colletotrichum lagenarium*) to a trace. *Bact. lachrymans* survived twenty months but not thirty-two months on the seed and did not appear to persist over winter in the soil. The *Colletotrichum* was found (as had been previously noted) to persist one winter in the field, but not twenty months, so that a two-year rotation should eliminate soil infestation with this fungus.

DOOLITTLE (S. P.). **Overwintering of the bacterial wilt of Cucurbits.** – *Phytopath.*, xi, 7, p. 299, 1921.

Previous evidence by Rand and his colleagues that the beetle *Diabrotica vittata* is concerned in the overwintering of wilt caused by *Bacillus tracheiphilus* is supplemented by the author's findings. These beetles were collected in the field in 1917 and 1919 before cultivated cucurbits had appeared, and placed on healthy cucumbers in the greenhouse. Several of the plants thus treated developed wilt and were the only ones to get this disease in the greenhouse during the past four years. Although the beetle feeds in early spring on *Micrampelis lobata* and *Sicyos angulatus*, these plants were never found showing wilt. No evidence was secured indicating that *Diabrotica* is concerned in mosaic overwintering, though *Micrampelis* is known to be an agency in carrying the cucurbit mosaic through the winter.

PALM (B. T.). **Aanteekeningen over slijmziekte in Arachis hypogaea.** [Observations on the slime disease of *Arachis hypogaea*.]—*Meded. Inst. voor Plantenziekten*, 52, 41 pp., 2 figs., 1922. [English summary.]

The slime disease or bacterial wilt of ground-nut (*Arachis hypogaea*), caused by *Bacillus solanacearum*, was first observed in the Dutch East Indies in 1905, and is now known to occur in many districts of Java, Sumatra, and other islands, causing an estimated annual loss of at least 25 per cent. of the crop. In severe attacks

the plant dries up so quickly that the leaves may remain green, but slight early infections involving only a part of the plant are sometimes overcome, the host recovering completely. The root system of affected plants shows a number of dead roots, those first attacked being dark in colour, while those further from the centre of infection are brown. Some of the nuts remain small, the shell often being brown-veined in consequence of the presence of bacteria in the vascular system. The characteristic bacterial slime that exudes from the vessels of the cut stem and roots is first readily detected in the later stages of the disease.

The appearance of the plant is not an index to the number of bacteria present. Healthy-looking parts are frequently filled with bacteria without even any discoloration of the affected vessels, and it is from these regions of the plant that the organism may most easily be isolated. The shell of well-developed fruits often contains bacteria, which penetrate also into the funiculus and even into the seed-coat, but they have never been found in the embryo.

The cultural characters of the organism are described. Gelatine is liquefied very slowly. On boiled potato a very characteristic colour change occurs, the culture gradually taking a deep grey to jet black colour. The change of colour appears after five to fifteen days at a temperature of 23° to 30° C. The different strains vary somewhat in their cultural characters; two, for instance, showed no growth when nitrogen was given as nitrate of potassium and carbon as laevulose, while another did.

Inoculations were carried out on the roots of pot plants of ground-nut, tomato, and tobacco. Typical disease symptoms developed in all cases, the controls remaining healthy. A number of new host-plants of *Bacillus solanacearum* in the Dutch East Indies have been discovered, viz. *Chenopodium ambrosioides*, *Beta vulgaris*, *Talinum racemosum*, *Rumex abyssinicus*, *Galphinia gracilis*, *Hibiscus sabdariffa*, *Linum usitatissimum*, *Daucus carota*, *Petroselinum sativum*, *Barleria lupulina*, *Coreopsis speciosus*, *Eleutheranthera ruderalis*, *Helianthus annuus*, *Senecio sonchifolius*, *Tagetes signatus*, *Verbesina alata*, and *Zinnia elegans*.

The disease appears to be favoured by humidity of the soil and is reported to be more prevalent on heavy clay. The planting of *Arachis* for several years in succession on the same land also increases the incidence of the disease. The whole question of the influence of the soil in relation to this disease is by no means clear. There is some prospect of improvement through selection, de Jong's experiments on these lines having already given satisfactory results. As the shells of nuts from diseased plants sometimes contain large quantities of bacteria they should be burnt after planting, not left heaped on the fields as is the custom. Where possible only seed from healthy plants should be planted.

GABEL (W.). **Ueber die Verwendung von Quecksilbersalzen zur Saatgutbeize.** [On the use of salts of mercury for the disinfection of seed.]—*Zeitschr. für angew. Chemie*, xxxiv, pp. 587–588, 1921.

Inorganic salts of mercury have been employed for the disinfection of seed in Germany since 1906, when they were intro-

duced by Hiltner. The use of organic salts of mercury is of more recent date, the first mention of it occurring in 1913. The simplest organic mercury compound is cyanide of mercury, which is said to be completely effective in preventing stripe disease of barley when used as a steep for the grain. Mercury chlorophenol, introduced by Remy for the steeping of cereals attacked by *Fusarium*, is the chief component of 'Uspulun'. Another organic salt of mercury is mercury cresol sodium cyanide, which is the chief ingredient of the new fungicide 'Germisan'. A third proprietary seed disinfectant containing mercury is known as 'Fusafine', which consists mainly of corrosive sublimate in association with common salt, sodium sulphate, and an azo colouring substance. 'Fusafine' contains about 20 per cent. of sublimate.

SHARPLES (A.). **Treatment of mouldy rot disease by application of 'Agrisol'.**—*Agric. Bull. Fed. Malay States*, ix, 3, pp. 184–191, 1921.

Field tests made with the proprietary fungicide 'Agrisol'—a coal-tar product—showed that under local conditions and used in the form of a 20 per cent. solution, at twelve-day intervals, it is a reliable preparation for the control of mouldy rot (*Sphaeronema* sp.) of *Hevea*. The conditions in some of the experiments were such as to test the fungicide very severely, previous treatment by the methods ordinarily used having failed, and the author believes that it would be equally successful under any conditions likely to occur on plantations run on progressive lines, though this point will require to be tested further by experiments in different localities. In lightly infected areas one application is seldom sufficient, two usually clear up the diseased bark, but in difficult cases three paintings are often necessary. In badly infected areas the treatment should be continued until the final eradication of the disease. Strict supervision is necessary, and a system of marking treated trees, such as the addition of colouring matter to the solution, must be employed to aid this. The fungicide is easily miscible with water, and strong solutions do not harm the tender cortical tissues of the tapped surface. The only precaution required is to stir the solution before applying, as some of the constituents have a tendency to settle.

GADD (C. H.). **The efficacy of formaldehyde vapour as a disinfectant of Tea seed.**—*Dept. of Agric. Ceylon, Bull.* 51, 8 pp., 1921.

In Ceylon the process of disinfection of tea seed imported from India, with a view to preventing the introduction of blister blight (*Exobasidium vexans*), is carried out by means of formaldehyde vapour. The tea seeds are placed in trays with wire gauze bottoms, which are kept on racks in an air-tight compartment. Formalin is then poured on to permanganate of potash, thus effecting the liberation and diffusion of formaldehyde vapour. After forty-five minutes the gas is allowed to escape and the seeds are removed.

Laboratory experiments to test the efficacy of this method of disinfection were conducted as follows: A large enamelled box with a capacity of 3½ cubic ft. was used as a fumigation chamber,

the seeds and spores being placed in sterile Petri dishes on the bottom of the box. Permanganate of potash (1 gm.) was placed in a small basin within the box, 2 c.c. of formalin being added immediately before closing the lid. The spores of eight different fungi were used, viz. *Penicillium glaucum, Aspergillus* sp., *Mucor* sp., *Pestalozzia palmarum, Botryodiplodia theobromae, Tricothecium roseum*, and two species of *Fusarium*, one cultured from rice and the other from tea seed. The spores of *Exobasidium vexans* were not tested, as the fungus is not known to occur in Ceylon, and it was considered inadvisable to import it even for experimental purposes. The following treatments were applied: (1) Dry Film. Four drops of water containing fungus spores in suspension were placed on the bottom of a sterile Petri dish with a sterile platinum loop and dried before fumigating. (2) Wet Film. As in (1) but fumigated before drying. (3) Masses of spores. Spores from cultures were placed in clumps on the bottom of the sterile dishes.

After fumigation sterile bean agar was poured into each dish. Controls were made as in (1) and (2), but were not fumigated. It was found that fumigation for forty-five minutes was sufficient to kill the spores of all species used when these were exposed as thin films. The masses of spores of all species except *Fusarium* were also killed. The latter developed even after two hours' fumigation.

Experiments were further undertaken to determine the effect of the treatment on spores present on tea seed. Twenty seeds were placed in a layer at the bottom of a sterile Petri dish and fumigated for forty-five minutes. Each seed was then placed in a sterile test-tube containing melted bean agar. Five other seeds were used as controls. The latter developed fungi and bacteria after the second day, while by the tenth day fungi had developed in all the tubes, but they were considerably fewer in those that had been disinfected than in the controls. In the treated tubes, *Fusarium* spp. predominated, but *Pestalozzia, Penicillium, Aspergillus*, and other fungi also occurred. The growth of the three last-named forms can only be explained, in view of the earlier experiments, by a failure of the gas to reach the spores, or by insufficient duration of treatment, or insufficient intensity of the gas concentration. In the treated tubes, growth began in many cases in the region of the hilum, and it was concluded that the spores on the surface of disinfected seeds had been killed, but not those that might occur in the micropyle or within the seed. No appreciable improvement in the results was obtained by increasing the time of fumigation or by preliminary soaking. Further experiments showed that spores do actually occur at times within the seed coat, and these were naturally not destroyed by the gas. In experiments to test the effect of the treatment on the germination of tea seed, it was found that slightly more treated than untreated seeds had germinated at the end of six weeks.

Seeds of other species were next tested, cucumber, pea, chilli [*Capsicum* sp.], melon, onion, maize, cow-pea, rice, bandakkai [*Hibiscus esculentus*], and Lima bean seeds being used. Petri dishes were employed instead of test-tubes. In all the controls bacteria and fungi were apparent on the third day. On the seventh

day there were no fungi in the dishes containing treated seeds of cucumber, pea, chilli, melon, onion, and Lima bean; they had, however, developed from one seed of maize, one of cow-pea (damaged by weevil), three seeds of rice, and two of bandakkai. Very few bacterial colonies were present in the treated dishes. Formaldehyde vapour is an excellent disinfectant of peas, beans, &c., but less efficacious with cereals and tea, owing to its inability to penetrate the glumes and seed coat respectively.

Previous experiments have shown that when tea seeds are exposed in four layers to the gas, it fails to penetrate to the middle layers in sufficient concentration to kill the fungus spores on the seed coats. An inspection of the disinfection process at the Government fumigatorium at Colombo showed that the formaldehyde vapour in some cases even failed to penetrate to the bottom of the seed in the top layer, while the lower layers were quite unaffected by it. This is no doubt due to some extent to the presence of powdered charcoal, used for packing, in the interstices between the seeds.

This method of disinfection must therefore be pronounced economically unsound. The results are not commensurate with the expenditure of labour and material, and there is no adequate safeguard against the introduction of fungous pests with the tea seed.

PETCH (T.). **Report of the Botanist and Mycologist for the 3rd quarter 1921.**—*Trop. Agric.*, lvii, 5, pp. 318–319, 1921.

Several cases of the leaf disease of tea caused by *Cercosporella theae* were recorded during the rains. In practically all cases this leaf disease begins on acacia and then spreads to the tea by means of wind-borne spores. *Acacia decurrens*, *A. dealbata*, and *A. melanoxylon* are all liable to this disease. There are several cases on record in which it has occurred in firewood reserves on *Acacia decurrens* and spread from that plant to interplanted *Eucalyptus robusta* (red gum), *E. diversicolor* (Karri), &c.

New diseases recorded during the quarter include black rot (*Corticium theae* Bern.) on coca (*Erythroxylon coca*). Root diseases of cacao and 'bunchy top' disease of plantains are under investigation.

On a rubber estate an orchid, *Dendrobium macarthiae*, was attacked by *Phytophthora faberi* at the same time as the pod disease, caused by the same fungus, was prevalent on *Hevea*.

SOUTH (F. W.). **Work of the inspection staff, July-September, 1921.**—*Agric. Bull. Fed. Malay States*, ix, 3, pp. 200–203, 1921.

DISEASES OF RUBBER.—Pink disease (*Corticium salmonicolor*) was for the most part under effective control during the quarter, the drier weather prevalent acting as a check. Two isolated cases were found at Chaban, this being the first authentic record from Malacca. Mouldy rot (*Sphaeronema* sp.) is still spreading and has appeared on an estate in Malacca. In Negri Sembilan a long spell of dry weather much reduced the severity of the disease in all districts except on holdings where the undergrowth was thick. In Temerloh district in Pahang the attack was severe in a small area

owned by Chinese. In Johore a few cases were found in the Johore Bahru district, but prompt measures resulted in checking the spread. In this State by far the most important outbreak is the recent one near Muar. This district is low-lying and damp, and the trees are closely planted, with a remarkable amount of undergrowth. A large majority have become infected with mouldy rot. The amount of infection is gradually being reduced, but the eradication of the disease is not even in view. Attention is being paid to clearing the undergrowth and to painting affected trees, but unless the former is attended to, the latter is of little use. Black stripe [*Phytophthora*] appeared again in Jelebu district, Negri Sembilan, in spite of the dry weather. Patch canker [*Phytophthora*] is reported to have attacked a few trees on an estate in Malacca. The trees were cut out and burnt.

Coco-nut Pests and Diseases. A serious attack of the moth *Brachartona catoxantha* in Province Wellesley is decreasing in severity mainly owing to parasitation by the fungus [*Botrytis necans* Massee] which commonly attacks the caterpillars. Very few moths appeared at the last emergence. Leaves with infected caterpillars were tied to infected trees elsewhere with a view to disseminating the fungus.

A[shby] (S. F.). **A fungous decay of Nutmegs in Grenada.**—*Agric. News* [*Barbados*], xxi, 519, p. 93, 1922.

A species of *Phomopsis*, apparently not previously described on this host, has been isolated from light, internally decayed nutmeg [*Myristica fragrans*] seeds, which are always present in the cured product and are removed by the graders before the seeds are bagged for shipment. In pure culture a white growth was formed, from which, after some weeks, arose black pycnidia extruding yellowish tendrils of *Phoma*- and *Phlyctaena*-like [A- and B-] spores. The fungus in question resembles *P. citri* Fawc., the cause of stem end rot and melanose of citrus fruits in Florida, except that the spores are smaller. Investigations into the losses caused by this fungus and as to whether it attacks the fruit on the tree or after falling are in progress.

Liese (J.). **Neue Beobachtungen über Cenangium abietis Pers.** [New observations on *Cenangium abietis* Pers.]—*Zeitschr. für Forst- und Jagdwesen*, xliv, 4, pp. 227–229, 1 fig., 1922.

One-year old pines sent for examination from Pomerania were found to be attacked by *Brunchorstia destruens* Eriks. (= *Br. pini* Allesch.), the conidial stage of *Cenangium abietis* Pers. The primary needles below the terminal bud turned yellow and died, while the apex gradually withered. Microscopic inspection revealed the presence of a mycelium in the bud and the discoloured portion of the cortex. Slightly above the dividing line between the diseased and healthy part black pycnidia, 1 to 3 by 1 mm., protruded from the cortex. The cavities of the pycnidia were filled with a large number of slightly crescent-shaped, hyaline conidia, mostly quadricellular, 30–40 by 3 μ.

The fungus is a facultative parasite, attacking the buds only under particular climatic conditions, such as alternations of humidity

and drought. It has hitherto only been observed on pines above five years of age.

FAULL (J. H.). **Some problems of forest pathology in Ontario. Needle blight of White Pine.**—*Journ. of Forestry*, xx, 1, pp. 67–70, 1922.

The forests of Ontario present a number of problems in pathology, many of which are of fundamental importance in relation to fire, productivity, stumpage values, and type succession. Pathological work now in progress includes a tabulation of the timber diseases of Ontario with respect to causal agents, host relationships, and distribution, foundation studies on the butt rots, and the investigation of various problems in response to special demands.

Butt rots are the principal destructive agencies at work in the Ontario forests, none of which is exempt. With increasing age the trees become more susceptible, and the final deterioration causes a serious loss in stumpage values. Butt rots are also responsible for the windfalls and their resulting débris which litter the forest with combustible material and increase the danger of fire. Butt rots are fortunately almost entirely restricted to mature or suppressed timber, young trees being immune.

One serious difficulty encountered in these investigations has been the absence of information on the identity of causal organisms. For instance, as far as the literature shows, no definite connexion has been established between balsam rot and any specific causal agent.

Other problems requiring solution are the rate of progress of butt-rot infestations and their relation to the age of the host species, to the specific resistance of the host, and to environmental factors. Skilled and patient investigation, which will greatly simplify the present and future administration of the forests, is also necessary in such matters as soil characters, crowding, mixed stands, and climate.

Particular attention has been paid to the needle blight of the white pine (*Pinus strobus*) which is specially prevalent in the northern Ontario stands. The first record of the disease dates from 1905, when it was observed in the Timagami Forest Reserve. The greater part of the subsequent researches were carried out in this locality.

The most noticeable symptom of the blight consists in a yellowing or reddening of the new needles shortly after their emergence from the buds at or about midsummer. The discoloration continues progressively from the tips of the affected needles downwards during a period of about a fortnight. As a rule the upper part of the tree is most severely attacked, and the extent of the blighting is generally uniform for all the needles of any single fascicle.

It was soon ascertained that the injury was neither a winter killing of the foliage, nor an enzymic disease, nor due to fungi or insects. It was, moreover, impossible to induce the disease in healthy branches by fusing them at freshly abraded spots with diseased branches of affected trees. It was discovered in 1919 that the source of the trouble was in the absorbing roots, which were dead in greater or lesser numbers in blighted trees, and were thus unable to provide the extensive supply of water necessary for the expansion of the new needles. The young needles consequently turn pale and

then redden from the tips downwards. The foliage of trees recovering from blight may be short, tufted, and pale, but other factors are involved in that connexion. The cause of the death of the absorbing roots has not been fully explained, but certain evidence suggests a drying out in periods of drought in shallow or leachy soils. White pine, though probably the most severely attacked, is not the only sufferer. Investigations are proceeding as to the other species of timber involved.

Another problem associated with needle blight is the difficulty of distinguishing it from the discolorations due to the sulphur fumes in areas within range of sulphur dioxide emanations. The two disturbances can only be differentiated with certainty at the growing season, Observations on both phenomena have shown that burning of the leaves from sulphur fumes occurs rapidly whenever temperature and humidity conditions are favourable, the injuries not being necessarily restricted to needles of the current season. Needle blight, on the other hand, takes place at a definite period in relation to the emergence of the needles from the buds.

Observations on the needle blight have now been carried on consecutively since 1918, and of 633 white pines whose histories have been followed 358 were blighted. Two of the remaining healthy trees became blighted in 1919 as a result of the partial lifting of the thin soil cover and its permanent displacement from its bed of broken rock. These trees died in 1921. The total percentage of deaths was 29·15, and there were 149 apparent recoveries. The results of these investigations indicate that young stands are not likely to be seriously depleted by needle blight, the percentage of deaths among trees with trunks 6 inches or less in diameter being only 6·8. In heavily blighted mature stands, however, the injury may be a deciding factor in the determination of the time of harvesting.

GUYOT (M.). **Notes de pathologie végétale.** [Notes on plant pathology.]—*Bull. Soc. de Path. Vég. de France*, viii, pp. 132–136, 1921.

Notes are given on certain diseases of plants observed during the summer of 1921 in the Somme district.

Cladosporium herbarum was common on wheat in spite of the dry season, especially in the less vigorous fields and those suffering most from the drought (chiefly calcareous soils). Not only the glumes but the enclosed grain was infected. *Fusarium culmorum* was fairly frequent on barley and oats but was not seen on wheat. Affected plants lodge readily. *Urophlyctis alfalfae* is often prevalent in old lucerne fields.

For some years past there has been a considerable amount of withering, with many deaths, amongst the elm trees in Picardy. The condition appears to have been observed in 1918 for the first time in young plantations in which the leaves suddenly turned yellow and fell off at the height of the vegetative season, leaf-fall being complete within ten days. Recovery did not take place subsequently. Older trees were also attacked but were more resistant and were not so often killed. The attack may be confined to certain branches which wither and die, the rest of the crown

remaining healthy. The topmost branches seem to be more liable to this partial attack than those at the base. After 1918 no further cases of new attack seem to have occurred. Naturally the condition described was attributed by the residents to the effects of the war, either to the use of searchlights and the like, or to poisoning with war gases. But this is negatived by the fact that areas far from the front line were affected, and also that many individual trees escaped injury throughout. No other tree but the elm has suffered. Trees on road-sides as well as those in fields and woods are equally damaged. The wood of affected branches shows a brown zone corresponding with the annual rings of the last few years, the colour being due to browning of the cell-walls and a deposit of brown or black granules in the cell cavities. The roots appear to be perfectly healthy. Attention is called to the similarity between this pathological condition and the walnut disease described by Gard [see this *Review* i, 3, p. 77], the cause of which is equally unknown. [See also this *Review* i, 8, p. 277.]

KLIKA (J.). **Einige Bemerkungen über die Biologie des Mehltaues.** [Some observations on the biology of mildew.]—*Ann. Mycol.*, xx, 1–2, pp. 74–80, 1922.

With the exception of the genus *Phyllactinia*, the mildews may be generally classified as ectoparasites. The external mycelium sends into the cells of the host-plant only haustoria, which penetrate by chemotaxis. It is generally believed that these haustoria only enter the cells of the epidermis, but the author has found that in several species, including *Erysiphe polygoni*, *E. cichoracearum*, *Uncinula aceris*, *Trichocladia astragali*, and *Sphaerotheca humuli*, they sometimes pass through the epidermal cells and penetrate into the cells of the palisade or spongy tissue, or even into the vascular bundles. This process occurs chiefly in older leaves in the autumn.

Dimorphism is a frequent phenomenon in mildews, and may be attributable partly to the degree of nutriment in the substratum and partly to the difference in the illumination of the upper and under side of the leaf. Thus, in *Myosotis silvestris*, the oidia of *Erysiphe cichoracearum* were spherical on the upper side and 14·5 μ in diameter, while on the under side they were oblong and 26 by 11·6 by 13 μ.

Zopf's fibrosin bodies have been observed by the author in the oidia of *Podosphaera leucotricha*, *Sphaerotheca humuli*, *Microsphaera alni*, *Oidium quercinum*, *Uncinula prunastri*, *U. aceris*, *Trichocladia astragali*, *Erysiphe polygoni*, and *E. cichoracearum*. They doubtless constitute an important reserve material, dissolving at germination.

The development of the perithecia is believed to be occasioned by a decline in the nutrient value of the substratum, the atmospheric influences which often coincide with this stage being of secondary importance. This view is supported by the extensive occurrence of the perithecial stage of oak mildew during the last two years, during which the abnormal drought has caused a deterioration in the nutrient value of the host-plant. Numerous perithecia were found by the author in 1921 on *Quercus pedunculata* and *Q. sessiliflora* in Bohemia, and they were also abundant on *Q. laurifolia* in

a locality where Vlach has observed them regularly in smaller numbers since 1916. They have always been found on leaves exposed to the sun and quite dried up, the oidia on these leaves having a relatively low power of germination.

A comparative examination of the perithecia occurring on the two first-named oaks, which are Bohemian species, with those of *Q. laurifolia*, which is American, revealed marked differences in the shape and length of the appendages. The specimens from the latter are characterized by long and elastic appendages which in their ramification resemble the American forms, while the perithecia of the native oaks, with their stiff, short appendages, are more like the typical form of *Microsphaera alni*. The difference in the hosts apparently accounts for this variation.

Inoculation experiments with *Oidium quercinum* [full details of which are given] showed that different forms of *Quercus pedunculata* vary in their degree of susceptibility to infection, the var. *pectinata* being susceptible, and var. *fastigiata* resistant. The latter may escape attack even when growing in close proximity to infected trees of other varieties. An attempt to transmit oak mildew from *Q. pedunculata* to *Q. rubra* failed. Mildew on the latter species has been very seldom reported and the author has failed to find any case in the trees he has examined.

Other inoculation experiments dealing with the specialization of forms of *Uncinula aceris*, *Trichocladia astragali*, *Sphaerotheca castagnei*, and *Erysiphe polygoni* are reported.

Division of Botany, Department of Agriculture [Canada]. Survey of the prevalence of common plant diseases in the Dominion of Canada, 1920.—*First Annual Report*, pp. v + 55 [Mimeographed, 1921].

This is the first plant disease survey report for the Dominion of Canada. It was prepared from reports made by collaborators in the different Provinces, and edited by W. H. Rankin and W. P. Fraser. The plant diseases of economic crop plants are listed, with notes as to their prevalence, seriousness, &c. The following summary covers some of the more important points.

Cereal Crops. Stem rust (*Puccinia graminis*) was widely distributed on wheat, oats, barley, rye, timothy, and other grasses. On wheat some damage was caused in Prince Edward Island and in Quebec, but, as usual, the greatest damage occurred in the western Provinces. In Manitoba, open aecidia were found first on June 11, and the first rust on wheat was found at Winnipeg on June 30; at later dates, rust caused much injury to wheat throughout the Province. In Saskatchewan, *P. graminis* was first found on wheat in the southern part of the Province on July 9, but was not collected from the northern agricultural areas until about the first of August, and on the whole the injury to wheat in Saskatchewan was not serious. In Alberta, damage was negligible; the rust was not collected at Edmonton until August 12, and no cereal rusts were found in the Peace River district. On the other cereals damage from stem rust was not, in general, serious. *P. coronata*, *P. dispersa*, and *P. simplex* are recorded for the Dominion, but were not

very prevalent in 1920. *P. glumarum* was found on *Hordeum jubatum* in Alberta.

The common cereal smuts were prevalent, and produced injury in greater or lesser amounts. The bunt of wheat in Manitoba and Saskatchewan was caused principally by *Tilletia tritici*. *Helminthosporium*, especially *H. gramineum*, was injurious to barley in certain areas. Some root-rots of cereals were attributed to this fungus. Wheat scab (*Gibberella saubinetii*), ergot, and other cereal diseases were reported but were not severe.

FLAX. *Melampsora lini* was common in western Canada on flax. *Fusarium lini* caused some wilt in Saskatchewan.

SUNFLOWERS. *Puccinia helianthi* and *Sclerotinia* sp. caused some injury.

FRUIT CROPS. *Venturia inaequalis* was not so serious as usual on apple. *Bacillus amylovorus* caused some damage to apples and pears. *Exoascus deformans* and *Sclerotinia cinerea* were not destructive. A number of other fruit diseases were found.

VEGETABLES AND POTATOES. A number of diseases are recorded. *Phytophthora infestans* did not occur in western Canada, except a small amount in British Columbia, but caused damage to potatoes in the eastern sea-board. *Rhizoctonia solani* was severe in Ontario and westward.

WEINZIRL (J.). **The resistance of mold spores to the action of sunlight.**—*Papers on Bacteriology and allied subjects. Univ. of Wisconsin Studies in Science*, 2, pp. 55–59, 1921.

Spores of the following moulds were exposed to direct sunlight on paper slips in glass Petri dishes: *Mucor* sp., *Aspergillus niger*, *A. fumigatus*, *A. nidulans*, *Oidium lactis*, and *Penicillium glaucum*. It was found that they were almost all able to withstand exposure of fifty-eight hours (or five days of continuous exposure) to the intense rays of a summer sun. This result contrasts greatly with the power of resistance exhibited by bacterial spores, which the author has previously shown (*Amer. Journ. Publ. Health*, iv, 11, p. 969, 1914) do not usually withstand more than five hours' exposure. This fact undoubtedly helps to explain the preponderance of viable mould spores in the atmosphere, as compared with bacterial spores.

As a partial explanation of this resistance the author suggests that the pigment in coloured spores exerts a protecting influence, though *Oidium lactis*, which has colourless spores, is equally resistant and forms an apparent exception. The relative lightness of mould, as compared with other, spores points to their having been more successful in climinating water from their protoplasm, and this may possibly have a share in enabling them to resist adverse agents.

RAINES (M. A.). **Vegetative vigour of the host as a factor influencing susceptibility and resistance to certain rust diseases of the higher plants.**—*Amer. Journ. of Bot.*, ix, 5, pp. 183–203, 6, pp. 215–238, 2 pl., 1922.

An extensive review of the literature is presented as indicating that, contrary to the general theory that vigorous organisms are

less liable to disease, in the case of the rusts factors which tend towards greater host vigour also increase the vigour of the rust attack on these hosts.

In order to test any possible influence of the seed upon the attack of rust on the progeny, twenty-five plots of wheat, eight of barley, and one each of oats and rye were planted, in an isolated area, with seed from various sources, ages, and conditions. Natural rust infection appeared simultaneously on all the plots of wheat on the same day, and likewise on all the plots of barley simultaneously.

Plots of wheat, rye, oats, and barley were sown on June 10, June 23, July 6, July 20, August 5, and August 25, and observations were made during the growing season as to the amount of rust on plants of different ages. In the case of wheat, rust [species not mentioned] invariably appeared when the plants were putting out their third leaf, then increased steadily until the leaves bore the maximum amount, after which the leaf sheaths became affected, and a few pustules developed on the stem. Thus on any date there was in general a greater amount of rust on the older than on the younger plants. The rust on rye followed much the same course as that on wheat. The oats differed in that no rust appeared on any plot until August 12, when four plots were up. It then appeared in about the same abundance on the four plots, and in its subsequent development, the older the plant, the greater the abundance of rust on it, and the larger the proportion in the teleuto stage. Little rust appeared on the barley.

Puccinia coronifera Kleb., *P. secalina* Grove, *P. triticina* Eriks., and *P. sorghi* Schw. were grown under aseptic conditions on seedlings in test-tubes. Seeds were treated with chlorine water, then allowed to germinate in Petri dishes, then transferred to plugged tubes containing a little water. The reserve food of the endosperm allowed the plants to reach the third leaf stage, and to produce a generation of rust. The inoculations were made with a small sterile platinum spatula. The four rusts mentioned were thus grown aseptically for 10, 6, 8, and 8 generations respectively, and that they remained free from external contamination was demonstrated by the fact that no bacterial or fungous growth took place when a rust-infected seedling was deposited on sterile agar.

In fifty-eight inoculations with one uredospore of *P. sorghi* upon *Zea mays*, infections were obtained twice. It was found necessary, however, to inoculate with more than one hundred spores in order to be certain that infection would result.

Variation was found, under similar greenhouse conditions, in the amount of teleutospore production by *P. coronifera* from different sources. From cultures showing variation in the amount of teleuto stage produced, selections were made from cultures producing teleutospores abundantly, and from other cultures of the rust showing few or no teleutospores. It was found that this tendency of spore production continued in succeeding generations, and that the factor of fungous constitution must be given consideration in work on the conditions of teleutospore production.

A susceptible sugar corn (maize) was used for tests in water cultures, and the plants produced under different conditions of nutrition were inoculated with *P. sorghi*. An increase in the in-

cubation period of the rust occurred with the depression in vigour and rate of growth of the host, and the pustules produced were smaller and produced decidedly fewer spores. The incubation period was shorter on the younger than on the older leaves of the same plant. Abundant rust infection was produced on chlorotic leaves of the corn grown in an iron-free nutrient. Chlorophyll is, therefore, not necessary for rust development.

A considerable series of soil culture experiments was carried through, using oat plants and *P. coronifera*. Here again, in general, the more vigorous host tissue supported a more luxuriant parasitic mycelium. Under a given soil treatment, however, the largest plants were found to have the least infection per unit area of most severely infected leaf, indicating that the selection of rapidly growing and early maturing varieties may mean not only the escape of the plants from rust, but a less severe attack. The writer concludes from his nutrition studies and from a review of the literature that it is questionable whether there is any direct relation between any environmental factor either physical or chemical, of the nature of a nutrient or stimulus, and susceptibility to rusts of the cereals.

A discussion is presented calling attention to the fact that there are various host-parasite relations; these relations may be those of symbiosis, of commensalism, or of more or less destructive parasitism. In the case of the rusts and various other parasitic fungi, the relation to the host is at first predominantly one of symbiosis, and only later does it reach one of destruction.

STEPHENS (D. E.) & WOOLMAN (H. M.). **The Wheat bunt problem in Oregon.**—*Oregon Agric. Coll. Exper. Stat. Bull.* 188, 42 pp., 5 figs., 1922.

Both *Tilletia tritici* and *T. levis* cause bunt of wheat in western Oregon, and are of approximately equal virulence. In the rest of the State *T. tritici* alone occurs. In Oregon wind-borne spores are the chief cause of infection.

Experiments in seed treatment have been carried out during a period of ten years. They show that solutions of formaldehyde and copper sulphate sufficiently strong to kill the spores may destroy or retard germination or give weakly plants unless the seed is rinsed in clear water after treatment with formaldehyde or in lime water after copper sulphate.

Formaldehyde solutions of 1 pint of commercial formalin to 45 gallons of water, and copper sulphate solutions of 1 lb. to 10 gallons of water were equally effective in controlling bunt. Seed treated with formaldehyde should be sown while the seed is still damp and only in moist soil, the copper sulphate treatment being preferable if the seed is to be stored or sown in dry soil. An important factor which causes reduced germination in treatment with fungicides, especially copper sulphate, is the injury sustained by the seed-coat in threshing. Grain threshed by hand under moist conditions is less liable to injury than that threshed in dry weather and by machinery.

Experiments are in progress to ascertain whether dusting with dry copper carbonate, which has successfully controlled bunt in

Australia and California without injury to the seed, is equally effective in Oregon.

Nearly twenty varieties of wheat, out of hundreds tested, were found to be so highly resistant to bunt that they may safely be sown without treatment. The following varieties combine resistance to bunt with a high yield: Turkey C. I. 1558 A; Turkey C. I. 1558 B; Crimean C. I. 2903–5; Turkey C. I. 3055; Crimean C. I. 4430; Turkey C. I. 1571 C: White Odessa C. I. 4655; Martin Amber C. I. 4463; Red Hussar C. I. 4843; and Turkey x Florence.

HOPKINS (E. F.). **Hydrogen-ion concentration in its relation to Wheat scab.**—*Amer. Journ. of Bot.*, ix, 4, pp. 159–179, 18 figs., 1922.

A study was made of the growth of *Gibberella saubinetii* in media at different hydrogen-ion concentrations, and of the growth of wheat seedlings and the production of seedling infection in soils at various hydrogen-ion concentrations.

The fungus will grow in culture at a wide range of P_H concentration, but a minimum was found to occur at P_H 5·5 to 6·0, the curve rising both on the acid and alkaline sides of this point. For the soil tests a soil having an original reaction of P_H 5·9 was used, and *N*/1 H_2SO_4 and *N*/1 NaOH were added to give ranges from P_H 3·4 to P_H 9·0. The seed of Fultz wheat was inoculated with spores of *G. saubinettii* from a single spore culture, and planted in the different soils in flats, and the surface of the soil was then sprayed with spore suspensions of the fungus. Here also there was apparently a P_H effect upon the fungus, for a minimum infection occurred in two series of tests at P_H 5·5. There is also apparently an acidity effect upon the germination of the seeds, resulting in a lessened germination at about P_H 5·5. The phenomena of infection doubtless depend on the reactions of both the fungus and the host to the hydrogen-ion concentrations. In highly acid and highly alkaline soils seedling infection was great; at and near P_H 9·0 all the seedlings were rotted before they reached the surface of the soil.

A soil reaction of P_H 5·5, at which the minimum in the infection curve occurs, is not an unusual one, and it would not be difficult to adjust the soil to this reaction.

HAMBLIN (C. O.). **Foot rot of Wheat caused by the fungus Helminthosporium.**—*Agric. Gaz. New South Wales*, xxxiii, 1, pp. 13–19, 5 figs., 1922.

A *Helminthosporium* which is not described, but is illustrated, was found to cause probably greater damage than *Ophiobolus graminis* in 1921 in New South Wales. The *Helminthosporium* attack is not necessarily in patches in the field, but may be scattered throughout the crop. Sometimes plants are attacked when nearly mature, or seedlings may be affected. The stooling is poor, the root system not properly developed, and the base of the plant is browned. In Take-all (*Ophiobolus*) the base is more blackened than browned, and the two diseases can usually be distinguished in the field. The yield of plants attacked by foot rot is reduced, and the grains are often shrivelled. Affected plants seemed also usually to be more susceptible to *Septoria*, *Erysiphe*, and rusts. The *Hel-*

minthosporium was found on wheat in Australia as early as 1913. All standard varieties are attacked, but late-sown, rapidly maturing wheats escaped heavy infection. It is not known whether the fungus may be seed-borne, but affected plants may produce clean seed.

A review of the literature regarding similar troubles elsewhere is given, and crop rotation, fallow, proper preparation of seed-bed, the use of good seed and of superphosphate, are recommended as control measures.

MOLZ (E.). **Ueber eine weitverbreitete Roggenerkrankung.** [On a widely distributed Rye disease.]—*Deutsche landwirtsch. Presse*, xlix, 41, p. 284, 1 fig., 1922.

During the first fortnight of May, 1922, a large number of specimens of rye plants from different parts of Saxony were submitted for examination to the Phytopathological Experiment Station at Halle. The accompanying reports stated that the damage started in relatively small areas, spreading later over a number of acres. The first symptoms of the disease were arrested growth, and a pale yellowish-grey anthocyanic discoloration of the leaves, accompanied by brown spots. Other pale spots, evidently due to frost, occurred on the leaves, the tissues being brittle at these points. Some of the leaves were curled, the heart-leaf frequently being twisted like a corkscrew. Finally the plants withered and died. Remarkable powers of resistance to this disease were displayed by the Petkus variety, while Himmel appeared very susceptible.

Insect and fungous parasites were absent, but soil samples from the affected localities were found to be strongly acid, the lime content being so small (0·035–0·05 per cent. CaO) as to be absolutely inadequate for the requirements of the plants. The disease is directly traceable to this deficiency of lime in the soil, owing to which the oxalic acid formed in the course of the metabolic processes of the plant could not be neutralized, and far-reaching disorganization, and finally death of the cells resulted. It was ascertained that the soils in question had for many years past been fertilized exclusively with green manures, sulphate of ammonia, and potassium, all of which increased the acid content out of all proportion to the scanty supply of lime present in the subsoil in these cases. The appearance of the symptoms in the late spring was doubtless due to the fact that the requirements of the seedlings in their early stages are largely covered by the reserves contained in the grain. It was only when the vigorous spring growth made further demands on the soil supplies that the deficiency of the latter became apparent.

Experiments in treating some of the dying plants with a lime solution having proved successful, it is believed that the immediate top dressing of the diseased rye fields with 2 or 3 cwt. of slaked quicklime per acre will effect the necessary control. In the autumn the fields should again be treated with carbonate of lime at the rate of 35 cwt. per acre. If the top dressing in the spring has been omitted for any reason, a mixture of 3 cwt. of caustic lime and 25 cwt. of ground uncalcined carbonate of lime per acre should be strewn over the fields, and ploughed in during the autumn. In soils such as those under discussion, nitrogen should never be given

in the form of sulphate of ammonia, but in that of Chile saltpetre or calcium cyanamide.

VEVE (R. A.). **The efficiency of the 'roguing' method for the eradication of the mottling disease.**—*Louisiana Planter*, lxix, 2, p. 30, 1922.

Since October 1917, when the first cases of mottling [mosaic] in sugar-cane were observed in Porto Rico, the Fajardo Sugar Company has been conducting experiments to ascertain the seat of the disease and to devise measures for its control. For one year all chemical compounds directly or indirectly affecting the vitality of the cane were tried: sulphate of ammonia, sodium nitrate, sodium chloride, calcium carbonate, potash, ashes, filterpress cake, ferric sulphate, magnesium nitrate, &c., all gave negative results. It was found that neither the soil nor manures, organic or inorganic, affected the development of the disease. Disinfection of the setts failed to check it when setts were taken from affected plants. All the Porto Rican varieties, of which there are over sixty, were found to be susceptible.

The adoption of 'roguing' (i. e. digging out all the diseased stools immediately they are found) in the Company's plantations immediately led to a great reduction in the incidence of disease. The decrease may be estimated as follows:—1918–1919, 0·5000 per cent. infection; 1919–1920, 0·1190 per cent.; 1920–1921, 0·0079 per cent.; and 1921–1922, 0·0020 per cent. It is concluded that roguing may safely be recommended in plantations where the infection does not exceed 15 per cent.

BRUNER (S. C.). **Sobre la transmisión de la enfermedad del 'mosaico' ó 'rayas amarillas' en la caña de azúcar.** [Notes on the transmission of 'mosaic' or 'yellow stripe' disease of Sugar-cane.]—*Rev. Agric. Com. y Trab.* [Cuba], v, 1, pp. 11–22, 5 figs., 1922.

This is the last of a series of articles by the author dealing with mosaic or yellow stripe disease of sugar-cane in Cuba. In the present section, after an account of the experiments of other workers to determine the mode of transmission of the disease, he describes those carried out by himself in Cuba. He was able to bring about infection of healthy plants in a low percentage of his trials by means of the aphid employed by Brandes in his trials (*Aphis maydis*), but states that as this insect does not normally attack sugar-cane under field conditions it cannot be taken seriously into account as an active agent in the spread of the disease. Of other insects regarded as possible carriers (*Kolla herbida* (*Tettigonia similis*); *Tettigonia* sp.; *Draeculacephala mollipes*; *D. reticulata*; *Myndus crudus*; *Stenocranus* (*Delfax*) *saccharivorus*; *Phaciocephalus* sp.; *Oliarus* sp.; *Monecphora bicincta*; *Pseudococcus calceolariae*; *P. sacchari*; *Sipha maydis*; *Thrips*; *Tarsonemus spinipes*; *Paratetranychus viridis*; *Euscelis bicolor*; *Liburnia* sp.; and *Aphis setariae*), only *Phaciocephalus* sp. is regarded as worthy of further investigation as it is suspected to be an active carrier of infection. The others are either proved non-carriers or else their activity as transmitters is thought to be negligible.

The author's inoculations with juice from diseased sugar-cane confirm the existence of this method of infection, but the remarkably low percentage of successes obtained shows that there are factors connected with the transmission of the disease which still await elucidation. In needle inoculations eight out of one hundred succeeded when the needle was rapidly inserted into the midrib of the leaf after passing through a living affected leaf. Inoculations of the growing point with the expressed juice of the top of the cane taken into a hypodermic syringe without exposure to air mostly failed, but two out of thirteen succeeded in one series and three out of ten in another. When no precautions were taken to exclude contact with air three out of fifteen succeeded in another series, which was exactly the same number of successes as in a set of fifteen inoculated simultaneously without exposing the juice to the air. Provided the inoculations are made rapidly there seems to be no advantage in excluding air. Several experiments were tried with juice that had been passed through a Chamberland-Pasteur filter, with negative results, but whether the failures were due to the exclusion of the infection agent, or simply to the oxidation of the liquid consequent upon the lengthy process of filtration, is not known.

FARNETI (R.). **Sopra il 'brusone' del Riso.** [On the 'blast' of Rice.]—*Att. Ist. Botan. dell' Univ. di Pavia*, Ser. II, xviii, pp. 109–115, 10 pl., 1921.

Prof. Montemartini, in publishing the following posthumous note of Farneti's, disclaims any desire to decide between the opposing views of the different authorities cited. As early as 1871 Garovaglio attributed rice blast to an ascomycete *Pleospora oryzae*; some years later, however, Cattaneo, who originally also held this view, discovered that a number of other fungi were present on affected plants, none of which could be regarded as the primary cause of the disease.

Briosi and Cavara found in 1892 that the fungus *Piricularia oryzae* was the most widely distributed parasite in the affected rice-fields, but were unable to trace any direct connexion between it and the disease. A special commission, nominated by the Ministry of Agriculture to inquire into the matter, also failed to secure conclusive proof that *Piricularia oryzae* was the immediate cause of blast. Exhaustive researches by this Commission into climatic and cultural conditions provided no clue to the origin of the disease. Voglino isolated bacteria from the roots of diseased plants and maintained, in papers published in 1897 and 1903, that blast was due to a bacterial rot of the roots. In 1902 Ferraris demonstrated by a series of accurate observations that the mycelium of *Piricularia oryzae* was distinctly parasitic in character, attacking the rice plants near the basal node of the ear and producing the typical symptoms of blast. The Japanese authorities, Miyabe, Hori, and Kawakami, studying diseases of the same general type as blast, attributed them in part to *Piricularia oryzae*, and in part to the *Helminthosporium oryzae* of the first two authors. But both they and Ferraris based their views on direct observation only and did not furnish experimental proof of the cause of the disease.

Subsequent workers in Japan and America have maintained that blast is caused by *Piricularia*, and Metcalf successfully induced the American form of the disease by artificial inoculations with this fungus. On the other hand, Brizi in a series of papers from 1905–1908 ascribed the disease to physiological disturbances induced by the effect on the root system of defective drainage and want of aeration, and this view was supported by Sorauer and others. Farneti took up the inquiry into the cause of brusone in 1904. After ascertaining that the Japanese and Italian diseases were identical, and that the various names for the disease referred merely to different aspects resulting from the more or less advanced stage of the diseased condition, he maintained that the various fungi associated with it were in great part only different forms of the one highly polymorphic species, which included *Piricularia oryzae, P. grisea, Helminthosporium oryzae, H. macrocarpum, H. sigmoideum, Cladosporium* sp., and *Hormodendron* sp. Farneti affirmed that rice blast is constantly associated with the fungus in question, and succeeded in reproducing all the typical symptoms of the disease by inoculations both from pure cultures and with spores taken directly from the plant. He has left a number of plates, &c., illustrating the behaviour of the parasite under different conditions, but these do not indicate his long and patient studies on the resistance of varieties, the characters of the attack on different parts of the plant and at different stages of its development, and the methods to be employed for the control of the disease.

The year 1909 brought the researches on rice blast in Italy to a close, since the disease, presumably owing to the introduction of resistant foreign varieties, ceased about that time to cause any anxiety. It is, however, characteristic of brusone that alternating periods of virulence and mildness occur, the disease temporarily disappearing as a result of new cultural methods or the introduction of improved strains, only to return with renewed severity. It is not impossible that renewed outbreaks may again revive the interest which it excited in the past.

The article is illustrated with excellent reproductions, some in colour, of Farneti's original plates.

KULKARNI (G. S.). **Smut (Ustilago paradoxa Syd. & Butl.) on Sawn (Panicum frumentaceum Roxb.)**—*Journ. of Indian Bot.*, iii, 1, pp. 10–11, 1922.

The author reports the occurrence of this smut on *Panicum frumentaceum* in Sind, and states that it has been previously recorded only from Pusa. The smut is stated to agree in every respect with the published description, except that germination is not exclusively by long, branched, septate hyphae. While this is the type obtained by sowing the spores in water, sowing in a nutrient solution (tomato broth) leads to the production of a true promycelium with sporidia which bud freely and produce secondary sporidia abundantly.

No treatment has previously been known, since the life-history of the smut had not been worked out. Experiments were carried out to test the effect of seed treatment with 2 per cent. copper sulphate solution in which the seed grain, previously dusted with

smut spores, was steeped for ten minutes. The treated seed gave a crop quite free from smut, while in the plots from seed similarly dusted with spores, but not steeped in copper sulphate solution, about 90 per cent. of the plants were smutted. Hence the author concludes that infection occurs in the seedling stage from spores adhering to the grain coats, and can be readily prevented by a copper sulphate steep.

ULBRICH (E.). **Kulturkrankheiten der Kakteen.** [Diseases of Cacti in cultivation.]—*Monatsschr. für Kakteenkunde*, xxxi, 8, pp. 113–121, 1921.

Excessive humidity of the atmosphere is very harmful to cacti and is the main factor in the causation of two serious diseases: cork disease and glassiness. Cork disease consists in the occurrence of irregular spots, with a corky and rusty appearance, on the stems, or of depressions and even perforations in the shoots. *Cereaceae*, *Mamillariaceae* and *Phyllocactaceae*, especially the last, are liable to the disease. In severe cases the shoots may be covered with spots, the tip only remaining green. The first symptom is a faint yellowish-green to rusty discoloration of certain spots, which frequently appear somewhat translucent. The disease is generally most severe in the *Opuntiae*, *Phyllocacti*, and *Epiphylla*, in which it frequently causes the destruction of the shoots, but even in milder cases the flowering capacity of the plants may be greatly reduced. A mild attack of the disease is characterized by the formation of cork in the cortex or deeper cells of the epidermis (which consists of several layers of cells), which leads to the development of small wart-like excrescences. The epidermal cells outside the cork tissue gradually dry up and are ruptured by pressure from the developing cells below. The torn remains of the epidermis form a rough, cracked surface over the cork. In very mild attacks the epidermis does not tear but extends evenly over the cork tissue, the excrescences and callosities retaining a smooth, greyish-white surface. The disease is due to excessive humidity of the air and is increased by over-shading. It is found usually in plant houses in which other leafy plants are growing, but the author has observed it on shady balconies in damp weather. Dry air and free exposure to light are the best preventives.

Glassiness not only disfigures the plants but may even destroy them. On the softer *Cereaceae* and on *Phyllocactus*, *Opuntia*, and *Epiphyllum* dark green translucent spots appear. A slight pressure crushes the epidermis at the diseased points, and the soft tissue beneath turns black almost immediately. The latter process occurs gradually in any case, so that the diseased parts present a greenish-black to inky appearance. In severe cases the shoot may die above the affected part, but in milder attacks a wound cork is formed which separates the diseased from the healthy tissue. The diseased tissues shrivel up, the epidermis is torn, and the healed wound leaves discoloured depressions behind. The disease is frequently complicated by the occurrence of bacteria in the affected tissue, which then falls to pieces.

An examination of the diseased tissue shows that the abnormally

elongated cells are full of glucose and poor in starch, the latter being entirely absent from the most severely affected parts, while the healthy cells contain an abundance of starch grains. The diseased tissues are very rich in crystals of calcium oxalate, occurring mostly as short octahedra, whereas in the healthy cells needle crystals (raphides) are chiefly found. The disease attacks cacti growing in very damp and warm greenhouses with other tropical leafy plants. The cacti recover when subjected to good ventilation and the removal of other plants. Excessive atmospheric humidity must therefore be regarded as the primary cause of glassiness, and, like the other disease, it can be checked by dry air and good lighting.

Though most cacti are typical light-loving plants, some species of *Phyllocactus* and *Epiphyllum* are injured by over exposure to the rays of the sun, the shoots turning red and becoming stunted in growth. This has been observed when the plants stand too near the glass. Excessive cold (temperatures near the freezing point) may cause a somewhat similar but less strongly marked coloration in *Phyllocactus*. Few cacti will stand temperatures below 5° C.

WELLES (C. G.). **Cercospora leaf spot of Coffee.**—*Philipp. Journ. of Science*, xix, 6, pp. 741–744, 1 pl., 1921.

The leaf spot of coffee caused by *Cercospora coffeicola* Berk. & Cke, which is now reported for the first time from the Philippine Islands, is commonly known in other countries as 'brown eye spot', 'brown eyed disease', or 'berry spot'. The disease is widely distributed in such important coffee-growing regions as Mexico, Cuba, Trinidad, Porto Rico, Java, Uganda, and India. The organism found in the Philippines agrees accurately with the descriptions of *C. coffeicola* furnished by previous investigators.

At present the attack in the Philippine Islands is confined to the leaves and occurs only on nursery stock. Of the five species of coffee grown at the Los Baños Experiment Station *Coffea bukobensis* is the only one affected, *C. liberica*, *robusta*, *congensis*, and *canephora* being immune.

The lesions are found mostly on the upper surface of the leaves and are light brown when young, the centre portion later turning greyish, with concentric striations and encircled by brown rings. Later they penetrate through the leaf and distinct spots are produced on the under surface. Sometimes the spots coalesce, and in severe cases the leaves turn brown and fall off. The typical *Cercospora* conidiophores and conidia are produced in the greyish central portion of the lesions. The formation of secondary conidia reported by Butler (*Fungi and disease in plants*, p. 485, 1918) has not been observed.

Spraying experiments with Bordeaux mixture prove conclusively that the 'brown eye spot' may easily be controlled and probably eradicated. Fortnightly applications are recommended.

Informazione.—*Boll. mensile della R. Staz. di Patologia vegetale*, iii, 1–3, p. 34, 1922.

In *Italia agricola* of 15th January 1922 Ciferri gives a short description of a disease on Reinette apples in the Italian Marches,

which he calls 'white pustule'. The surface of the ripe fruit is covered with numerous rounded pustular crusts, averaging 3 to 4 mm. in diameter, slightly raised, with a blackish margin and a delicate whitish powdery scurf in the middle. This efflorescence is formed by the fructifications of *Trichothecium candidum* Wallr., the mycelium of which penetrates into the flesh up to the core, and brings about a gradual mummification of the fruit. This fungus behaves as an occasional parasite, penetrating through cracks in the rind. The diseased fruits have a bitter taste and are of no commercial value. It is believed that this disease is closely related to the bitter rot of apples due to *Trichothecium roseum*, and that these two forms are but different strains of the same species.

STEVENS (N. E.). **Rots of early Strawberries in Florida and southern California.**—*Amer. Journ. of Bot.*, ix, 4, pp. 204–211, 4 figs., 1922.

The most common cause of decay of ripe strawberries in Florida is *Rhizopus nigricans*, but this fungus is of minor importance on winter strawberries in California. *Botrytis cinerea* is the commonest fungus on strawberries in California, but occurs only under conditions of extreme moisture in Florida. The author made a comparison of weather records of the two regions, and concludes that the difference is to be explained partly by the fact that there are more favourable moisture conditions during the winter season in California, but more especially because the temperatures during the day are lower in California from January to April than in Florida, and therefore favour *B. cinerea*, which is known to have a lower optimum temperature than *R. nigricans*.

BROOKS (C.) & COOLEY (J. S.). **Temperature relations of stone fruit fungi.**—*Journ. Agric. Res.*, xxii, 9, pp. 451–465, 24 figs., 1921.

Tests were made with the *Monilia* stage of *Sclerotinia cinerea* and with *Rhizopus nigricans*. Naturally infected sweet cherries were placed at temperatures of 0°, 5°, 10°, 15°, and 20° C. After ten days all the fruit at 15° and 20° showed rot, and nearly all that at 10°. Two-thirds of the cherries at 5° were rotted and one-third of those at 0°. Prunes were inoculated with *Monilia* and *Rhizopus* and kept at temperatures of 0°, 5°, 7·5°, 10°, and 15° C. After five days rot was well developed from both fungi on those kept at 10° and 15°.

A number of tests were made with peaches. *Monilia* was found to grow on peaches at lower temperatures than it would grow on potato-dextrose agar, while the reverse was true with *Rhizopus*. Both fungi grew at lower temperatures on ripe fruit than on green fruit. After *Monilia* had a start, a temperature of 2½° held it in check for six days. A temperature of 10° held *Monilia* in check for only one or two days, and *Rhizopus* for three days. The rots develop three to five days later if held at the lower temperatures immediately after inoculation, indicating the value of good refrigeration from the time the fruit is picked. *Rhizopus* is more readily checked by lower temperatures than is *Monilia*; at 7½° it is practically eliminated.

BROOKS (C.) & FISHER (D. F.). **Transportation rots of stone fruits as influenced by orchard spraying.**—*Journ. Agric. Res.*, xxii, 9, pp. 467–477, 6 figs., 1921.

Fruit from sprayed trees develops during transportation or storage much less rot caused by *Sclerotinia cinerea* than occurs on fruit from unsprayed trees. In the case of sweet cherries, fruit from orchards in which there was less than one per cent. of rot on either sprayed or unsprayed fruit at picking time developed later 24·3 per cent. rot on the fruit from unsprayed trees and only 6·4 per cent. on that from sprayed trees. With Italian prunes the figures for rot during storage and transportation were 28 per cent. from unsprayed trees and 7·1 per cent. from sprayed or dusted trees.

Spraying or dusting the trees exerts little influence on the development of *Penicillium* and *Rhizopus* rot in transportation and storage. The occurrence of bruises and skin punctures are important factors in the development of rots caused by these two fungi.

WELLES (C. G.). **Cercospora leaf spot of Averrhoa carambola.**—*Philipp. Journ. of Science*, xix, 6, pp. 747–750, 2 pl., 1921.

A very serious leaf spot, causing partial or total defoliation of *Averrhoa carambola* L., has been observed at the Los Baños Experiment Station. *A. carambola* is a native of tropical America, and is now widely distributed in all tropical countries, but apparently this is the first instance of leaf spotting recorded on it. The spots were first noticed during the last week of June 1921, at the beginning of the wet season. At this time the attack was very slight, but by July 15 the trees were already partly defoliated, 100 per cent. of the larger leaves showing from one to ten lesions each. When young the lesions appear as irregular, yellow, chlorotic spots with a maximum diameter of 3 to 5 mm. The chlorotic areas may coalesce, giving the leaf a mottled appearance. Old and young leaves are similarly affected. Later the central tissue of the lesion dies and turns greyish-brown, surrounded with a band of chlorotic tissue 1 to 2 mm. in width. At a certain stage of development both dead and chlorotic tissues fall out, resulting in a shot-hole condition. In severe cases the leaves turn yellow, and this is followed by defoliation. It would appear that such complete defoliation will lead to the death of affected trees if not checked. Black lesions form on many fruits but cause no noticeable damage. Their connexion with the *Cercospora* leaf spot is probable, but not definitely established. The kindred species *A. bilimbi* L., which is extensively grown locally, appears to be immune.

The disease is caused by a *Cercospora*, which the author names *C. averrhoi* n. sp. The conidiophores emerge through the stomata and are light brown, erect, simple, 5- to 7- septate, and average 52 by 5 μ. The conidia are hyaline, short, straight, or slightly curved, tapering above to a blunt point, and measuring about 28 to 67 by 3 to 5 μ. They have 4 to 7 septa. Isolation was readily accomplished by planting the diseased tissue directly on corn meal medium, but the cultures were not maintained long enough to produce spores.

The results of fortnightly applications of Bordeaux mixture were very satisfactory, the number of new infections being reduced by 80 per cent., notwithstanding the frequent heavy rains. Complete eradication of the disease should be possible by these means.

SPEGAZZINI (C.). **Sobre algunas enfermedades y hongos que afectan las plantas de 'agrios' en el Paraguay.** [Notes on some diseases and fungi affecting sour fruit trees in Paraguay.]—*Anales Soc. Cient. Argentina*, xc, pp. 155 et seq. [pp. 1–36 of the reprint], 1 pl., 1921.

In Paraguay, citrus fruits were formerly one of the staple products, but in all localities recently visited by the author, signs of great neglect were apparent in the plantations, the lack of profitable markets for these fruits having led growers to concentrate on the cultivation of more remunerative crops. As a result of this neglect the different diseases affecting Paraguay citrus trees were studied under particularly favourable conditions. The main injury was found to be caused by fungi and the present paper gives a survey of the fungous flora (including the saprophytes) found on citrus in this area.

Gummosis is very common, and besides damaging Aurantiaceae, from the most suceptible *Citrus aurantium* through *C. limetta*, *C. medica*, *C. limonum*, and *C. deliciosa* in a diminishing order of susceptibility to *Citrus bigaradia* which is highly resistant to the disease, it also attacks such different plants as *Mangifera indica*, *Rheedia brasiliensis*, *Santalum album*, *Eugenia jambos*, &c. The author considers the disease to be exclusively due to infection by *Bacillus gummis*, but it is often found associated with a non-parasitic rot apparently caused by unsuitable soil conditions. The latter is most severe on the mandarin (*C. deliciosa*).

Leaf wart or red scab is found on *C. limonum*, *C. medica*, and *C. aurantium*, rarely on *C. limetta*, and may cause considerable damage. Though the disease is generally ascribed to *Cladosporium citri* Massee, the author suggests that this fungus may only be secondary to some microzoal parasite. It is distinct from the 'white rust' described by Briosi and Farneti, of which specimens were received from Chile for comparison.

Lepra explosiva [eruptive leprosy] is a hitherto undescribed disease affecting *C. aurantium* and possibly endemic in Paraguay, where it is widely distributed, especially in the northern region. It is considered serious although its spread is slow. There are three distinct phases of the disease. The first is characterized by the sudden appearance of isolated, discoidal or elliptical spots, 5 to 10 mm. in diameter, about half-way up to the vigorous, juicy, green shoots of the current year. The spots are surrounded by a sharply defined furrow about 0·5 mm. wide, and are cinnamon or fawn-coloured, and smooth except in the centre where a small, round, greyish, sunken pit occurs. A little later black granules appear in the encircling furrow and these rapidly become hemispherical, being 1 mm. in diameter and in height, and somewhat flattened at the top. They are corky-carbonaceous, hard, smooth, not shiny, and of the same colour throughout; their number increases until they form a complete belt around the spot, though

without coalescing. They constitute one of the sporing stages of the fungus which causes the disease and are made the type of a new genus, *Pseudhaplosporella* (a Dothideaceous form of *Haplosporella*), the species being named *P. aurantiorum*. The vascular bundles of affected shoots are blackened, and the cortex changed to a reddish, somewhat powdery mass. Thin, colourless or greyish hyphae are found in the diseased tissues, especially below the centre of the spots, in union with the stromatic fructifications.

In the second phase of the disease the spots gradually increase in number, and twigs of the second year become attacked. Eventually the spots coalesce, losing their typical form, and the whole of the affected surface is covered with a tan-coloured substance, much wrinkled and furrowed, in which are numerous regular or irregular stromatic nodules varying in size between 0·5 to 2 mm. in breadth and 0·25 to 0·5 mm. in height. The leaves on these diseased twigs turn yellowish and tend to roll upwards at their margins, becoming detached and falling readily. The medulla of the affected twigs is more or less dried up but without change in colouring; the woody tissues are almost normal though tinted grey; while the phloem shows marked signs of a more or less profound alteration, the reddish tissues being swollen and friable, and containing thin bundles of dark mycelium. This stage of the disease is associated with a second pycnidial form of the fungus, named by the author *Paradiplodia aurantiorum* n. g., n. sp. This is a Dothideaceous form of *Diplodia*.

At the same time a third stage, *Ephelidium aurantium* n. g., n. sp., is sometimes found at the older points of attack, forming stromata of slightly larger size than those above mentioned. These stromata bear on the surface a number of small depressions lined with spore-bearing hyphae and fringed with a circle of stout setae with short, blunt, obtusely bifurcate branches or processes near the tip. The acervuli are 0·1 to 0·2 mm. in diameter and the conidia straight or curved, hyaline, 3- to 5-septate, and 40 to 50 μ by 4 to 5 μ.

The third phase of the disease may take either of two forms. One is the further extension of the spots, which may spread down to the primary branches and the upper portion of the trunk and thence ascend to the remaining branches of the crown, the three peculiar metagenetic stromatic forms of the fungus appearing with more or less frequency as the disease spreads. The other consists of a restricted number of isolated eruptive lesions of fairly large size on the principal branches and trunk of the tree, extension being usually downwards. In this form neoplastic nodules are formed endogenously, producing first a swelling of the cortex and then, under constantly increasing pressure from within, finally rupturing the bark and causing three or four radial rents which may be up to 5 cm. in length. The lesions gradually increase in size, some reaching a diameter of 20 cm. and a height of 5 cm., but they remain whitish, hard, and fresh in appearance, with no exudation or secretion from them. It is possible to follow this extension of the disease from the smaller branches affected during the second stage, by greyish linear markings in the inner bark, which run down to he older branches and converge at the points

where the neoplastic growths originate. Only a few dark hyphae can be detected along the course of the markings in the inner bark and in the centre of the nodules.

Finally, crowns of diseased trees lose their leaves and from the collar of the root arise numerous, more or less vigorous suckers, only to dry up very shortly without apparent cause. During this last period the stromatic eruptions on the branches and twigs continue to increase. In the interior of some of the *Ephelidium* stromata very small globose cavities develop in which asci are formed. To this perfect stage of the fungus the name *Amylirosa aurantiorum* n. g., n. sp., of the Dothideaceae is given. The loculi occur either in a single series or in two superimposed rows, without ostioles. The asci are cylindrical, 80–100 × 10–14 μ, obtusely rounded at the apex, and contain 8 elliptical, fuliginous spores, with 1 to 5 septa and often a vertical septum in one or other of the central cells, 15 to 20 by 6 to 8 μ, slightly constricted at the septa. Paraphyses are present.

The author recommends that a survey should be undertaken to determine the amount of damage caused by this disease and meanwhile advises the removal and burning of affected trees, the cleaning up of the plantations, especially as fallen twigs may bear the fungus, and spraying with Bordeaux mixture.

The paper terminates with a systematic list, copiously annotated, of all the fungi found by the author growing on living or dead citrus trees in Paraguay, twenty-nine species being enumerated, of which thirteen are new. The microscopic characters of *Amylirosa aurantiorum* in all its stages are illustrated.

CIFERRI (R.). **Notae mycologicae et phytopathologicae. 8. Sulla biologia e la sistematica di una n. sp. del genere Dothiorella.** [Mycological and phytopathological notes. 8. On the biology and systematic position of a new species of the genus *Dothiorella*.]—*Ann. Mycol.*, xx, 1-2, pp. 40–41, 6 figs., 1922.

A parasitic fungus occurring on the rind of pomegranates at Alba (Piedmont) is described as a new species, *Dothiorella sanninii* Cif., and a Latin diagnosis is given.

Minute black pustules completely covered the epidermis of the affected fruit, almost obscuring its natural colour. Scabs were formed, composed of from two to six of these pustules. The fungus was isolated and grown in pure culture, and was readily inoculated into healthy fruit. On these, orange-coloured excrescences quickly emerged from a dark brown basal stroma, attaining a maximum size of 8-12 μ [?]. The excrescences, which gradually turn brown, are piled one on top of the other, the mass sometimes bending under its own weight or bifurcating. In many cases the fungus fails to develop further. In others pycnidia arise as superficial pear-shaped bodies in small clusters. The pycnospores are expelled from the ostiole in a yellow gelatinous globule, and are hyaline, bacillar, cylindrical, straight or slightly curved, continuous, and 4·5 to 5 by 0·8 to 1 μ in diameter. Their germination was not observed. The form of the basidia, which usually have three sterigmata at the apex, may ultimately form the basis for a separate subgenus of *Dothiorella*. Similarly branched or

verticillate basidia are known in *D. tulasnei* Sacc., *D. stromatica* (Preuss.) Sacc., and other species.

In the *Coltivatore* of 30th December 1921 (no. 36) the author gives a brief description of the effects of this disease under the title of 'La rogna della melagrana' [pomegranate scab]. It attacks only the rind of the fruit, but damages it to such an extent as to render it unfit for sale. In order to avoid the spread of the disease, particularly in storage, he recommends the immediate removal of all infected fruits and states that storage in heaps should be avoided, each fruit being placed separately, as infection occurs readily through contact when there is any slight injury to the rind.

VAN OVEREEM-DE HAAS (C. & D.). **Verzeichnis der in Niederländisch Ost-Indien bis dem Jahre 1920 gefundenen Myxomycetes, Fungi und Lichenes.** [Catalogue of myxomycetes, fungi, and lichens found in the Dutch East Indies up to the year 1920.]—*Bull. Jard. Bot. Buitenzorg*, iv, 1, pp. 1–146, 1922.

Accompanying this comprehensive catalogue of the myxomycetes, fungi, and lichens of the Dutch East Indies is a brief list of the Dutch and foreign workers who have collected them. Most of the collections have been worked out in Europe and America, the types being scattered in various herbaria and not fully represented at Buitenzorg. References are given under each species to the record of its collection and the island or islands in which it has been found. The myxomycetes are stated to be the best known group, the fungi being chiefly known only as far as the parasites and some of the more conspicuous groups are concerned. Nevertheless, the fungi listed number 2,232, apart from 97 myxomycetes and 503 lichens. Some records from outside Dutch territory (e.g. from Sarawak and English and German New Guinea) are included. The list terminates with a complete bibliography.

DAVIS (D. J.). **The identity of American and French Sporotrichosis.**—*Papers on Bacteriology and allied subjects, Univ. of Wisconsin Studies in Science*, 2, pp. 104–130, 1921.

A disease found all over the world and known as 'sporotrichosis' affects both animals—notably rats and horses—and man. In the United States it occurs chiefly in the Missouri Valley, the number of human cases observed so far approximating to one hundred, though this figure is in practice probably greatly exceeded as not all cases are reported. In America, Schenck, in 1898, was the first to isolate the causal organism, a Hyphomycete, from chronic subcutaneous abscesses in a human patient, and Hektoen and Perkins, who observed a second case in 1900, named the fungus *Sporothrix schenckii*. After a comparison of the cultures both they and Schenck agreed that the fungus was the same in both cases. In France the disease is relatively common, and there, as well as in most continental countries, it is referred to *Sporotrichum beurmanni*, isolated by de Beurmann and Gougerot in 1903, and named in 1905 by Matruchot and Raymond. The French workers first learnt of the American cases in 1906. The French and American forms have

hitherto usually been regarded as distinct species, though some American writers on the subject occasionally refer to the American organism as *S. beurmanni* or *S. schenckii-beurmanni*, but the author gives strong reasons for holding that they are identical or at the most only strains of the same species. Several other species have since been recorded from different countries as human parasites, the chief being *S. dori*, *S. indicum*, *S. gougeroti*, *S. jeanselmii*, and *S. councilmani*, but they are rare, and some seem scarcely to differ from the commoner form. In 1906 de Beurmann and Gougerot examined a culture from the original American strain of Hektoen and Perkins, and pointed out certain differences which, they contended, justified its separation as a distinct species, but the disease, clinically, pathologically, experimentally, and therapeutically, is admittedly identical in both countries.

The author emphasizes the pleomorphic changes [which are described in detail] observed in cultures of the fungus from both French and American isolations, some of these changes being transient and others of a permanent nature, and suggests that the differences alleged by the French workers are fully covered by this tendency. The proposal by Greco, concurred in by Meyer, to compromise by using the term *S. schenckii-beurmanni* is deprecated, not only because it further complicates an already ponderous nomenclature, but also because it is contrary to scientific usage. Precedence is clearly in favour of the name *S. schenckii*. It is admitted even by French workers that the subsequent isolations made from American cases are identical with the French fungus. The author is personally convinced that these subsequent American isolations are all the same fungus as that described by Hektoen and Perkins. Even if it is maintained, however, that the small differences observed between the pleomorphic forms of the original Schenck-Hektoen strain and the other Sporotricha justify its maintenance as a distinct species, the important fact remains that the hundreds of isolations since made in France and in North America are all alike and that sporotrichosis as it commonly occurs, not only in these countries but in most others, is caused by a single species of *Sporotrichum*.

GONZALEZ FRAGOSO (R.). **Esferopsidales nuevos ó poco conocidos de la micoflora española.** [New or little-known Sphaeropsidales of the Spanish fungous flora.]—*Asociación Española para el Progreso de las Ciencias. Congreso de Oporto, VI. Ciencias Naturales*, pp. 35–57, 6 figs., 1921.

This is an annotated list of new or little-known Sphaeropsidales in Spain.

Phyllosticta rabiaei (Pass.) Trotter causes the anthracnose of the chick pea or gram (*Cicer arietinum*), a disease usually attributed to *Ascochyta pisi* Lib. Previous Spanish records have included this disease with the anthracnose of peas and other leguminous plants as all caused by the last-named fungus. While the fungus described by Trotter is usually responsible for the disease on *Cicer arietinum*, the author thinks it not impossible that *A. pisi* may occasionally attack this host.

Notes are given on a number of other species, many of which are new or not previously recorded in Spain.

GONZALEZ FRAGOSO (R.). **Algunos Demaciaceos de la Flora española.** [Some Dematieae of the Spanish flora.]—*Bol. R. Soc. Esp. de Hist. Nat.* xxi, 1, pp. 93–99, 1 fig., 1921.

A list of 42 species of Dematieae found in Spain and the Balearic Islands is given, *Helminthosporium smilacinum* on withered tendrils of *Smilax aspera* and *Cercospora latens* Ellis & Everh. forma *europea* on leaves of *Psoralea bituminosa* being described as new. The list includes *Cycloconium oleaginum* Cast. on leaves of *Olea europea*; *Fusicladium depressum* (B. & Br.) Sacc. var. *petroselini* Sacc. on leaves of *Petroselinum sativum*; *Cladosporium compactum* Sacc. on leaves of *Citrus aurantium*; *Cladosporium pisi* Cug. & Macch. on pods of *Phaseolus vulgaris*; *Polythrincium trifolii* Kze on leaves of *Trifolium procumbens* and *T. arvense*; *Clasterosporium carpophilum* (Lév.) Aderh. on leaves of *Amygdalus communis*; *Cercospora bolleana* (Thüm.) Speg. on leaves of *Ficus carica*; and *Heterosporium variabilis* Cke on leaves of *Spinacia oleracea*.

PETCH (T.). **Studies in entomogenous fungi.**—*Trans. Brit. Mycol. Soc.*, vii, 1–2, pp. 89–132, and 3, pp. 133–166, 3 pl. (2 coloured), 1921.

This paper deals with the Nectriae parasitic on scale insects found in collections made for the most part in Ceylon but including also species from India, Japan, Formosa, Australia, Florida, the West Indies, and South America. The specimens preserved in the herbaria of the Royal Botanic Gardens, Kew, and of the British Museum (Natural History) have also been examined.

The genera treated are *Nectria* (with conidial stages belonging to *Tuberculariа* and *Pseudomicrocera* n. g.), *Lisea*, *Sphaerostilbe* (with conidial stage belonging to *Microcera*), *Calonectria* (with conidial stage belonging to *Discofusarium* n. g.), *Podonectria* n. g. (with conidial stage *Tetracrium*), *Broomella*, *Patouillardiella*, and *Fusarium*.

Three new genera are described: *Pseudomicrocera*, to contain the conidial stage of *Nectria diploa* B. & C., previously described as *Aschersonia henningsii* by Koorders and as *Microcera* by Miyabe and Sawada, Sydow, and Petch; *Discofusarium* for the conidial stage of *Calonectria coccidophaga* Petch n. sp., previously known as *Microcera tasmaniensis* McAlp, and *M. mytilaspis* McAlp; and *Podonectria* for certain species parasitic on scale insects previously referred to *Ophionectria* and other genera, but agreeing amongst themselves in having thick-walled asci, long multiseptate ascospores, and a *Tetracrium* conidial stage.

On p. 95 there is a list of all the species of Nectriae and their probable conidial stages that have hitherto been recorded on scale insects, but many of the twenty-nine species therein mentioned have now been reduced as a result of the author's studies, and he has added six new species, besides one new conidial stage of an existing species. Full historical and taxonomic notes, based in many cases on the examination of type specimens, are given, and the distribution of the species is recorded.

It is proposed to emend the genus *Corallomyces* so as to include

only those species that are co-generic with the type, *C. elegans*, namely those having *Nectria* perithecia, with a stilboid conidial stage and continuous conidia; *Sphaerostilbe* being at the same time emended to contain species with *Nectria* perithecia, a conidial stage belonging to *Microcera*, and elongated, septate conidia. It is pointed out that the *Microcera* stages of different species of *Sphaerostilbe* cannot be distinguished from one another in the absence of the perithecial stage.

The coloured plates, painted by Alwis, are of great beauty. A bibliography is appended.

LE MOULT (L.). **Le Hanneton et son parasite.** [The Cockchafer and its parasite.]—*Comptes rendus Acad. d'Agric. de France*, viii, 21, pp. 596–601, 1922.

Thirty years ago the author was entrusted with the formation of syndicates for the destruction of the cockchafers and their larvae all over France. In the course of this mission, which incidentally resulted in a saving of 600,000,000 francs, he discovered a fungus, *Isaria densa* Giard (*Botrytis tenella* Sacc. according to Prillieux & Delacroix), causing a disease of cockchafers (more especially of their larvae) analogous to the muscardine of silkworms. The fungus was cultivated and employed against the insects for several years on a very extensive scale, with the result that the cockchafer pest was completely exterminated on all the farms and estates into which *I. densa* was introduced. Owing to the author's prolonged absence from France subsequent to these experiments, the whole question of cockchafer extermination was allowed to drop. In 1911, however, the fungus was found still present in a field at Gorron (Mayenne) which had belonged to the former syndicate, and innumerable mummified larvae were obtained on digging the potato crop with which it had been planted. As recently as last March and April the author received some fifty or sixty more of these mummies, and cultures were immediately made from their interiors.

In the experiments mentioned above, 5 kg. of the cultures were generally mixed with a hectolitre of sand or soil and spread over the ground immediately before tilling. Cultures of other parasites were also used, including *Isaria destructor*, *I. farinosa*, and *Sporotrichum globuliferum*, in the hope of destroying other soil larvae, e.g. *Anisoplia austriaca*, *Elater segetis*, and *Agrotis segetum*. The author indeed believes, though he cannot produce direct evidence in support of his belief, that the method is universally applicable to insect pests, such as *Cochylis*, *Phylloxera*, and the like.

In 1914 a bacillus was accidentally discovered apparently living in symbiosis with *Isaria densa* in the larva of the cockchafer. The two parasites develop together in culture, the bacillus penetrating the substratum while the fungus grows on the surface. These mixed cultures were used in Vaucluse against the cockchafer larvae and in Ardèche against the peach aphis. The insects were rapidly killed and their bodies turned black, instead of white as in the case of *Isaria densa* used alone. The bacillus has not yet been identified, but is believed to be a new and extremely virulent parasite which destroys the insects in less than twenty-four hours.

VEITCH (R.). **A fungous parasite of the Hornet.**—*Agric. Circular* [*Dept. of Agric., Fiji*], ii, 5, pp. 114–115, 1921.

In May 1921 the writer noticed in the sugar-cane fields in the Nausori district large numbers of hornets (*Polistes hebraeus* F.) attacked by a fungus which was later identified at the British Museum as *Isaria crinata* Felton, a fungus first recorded from the West Indies. The number of hornets found dying or dead, a large proportion of which were females, was ample enough to justify the recognition of the fungus as an effective check on the propagation of the pests; this view is supported by the observations of the residents in the district, who state that the hornet has greatly decreased in numbers of late years. Indications go further to show that the fungus is active throughout the year and not at one season only. So far it has not been found on hornets in the dry districts of Fiji.

ROSS (H.). **Weitere Beiträge zur Kenntnis der verpilzten Mückengallen.**—[Further contributions to the knowledge of fungus-infested fly-galls.]—*Zeitschr. für Pflanzenkr.*, xxxii, 1–2, pp. 83–93, 1922.

This paper forms a continuation of the author's earlier publication (*Ber. deutsch. botan. Gesellsch.*, xxxii, p. 574, 1914). It gives an account of the distribution, systematic position, and biology of the galls. The fly-galls are very widely distributed in Central Europe, and occur also in South America. Fungous infection of the galls is the rule in most of those due to Asphondylariae and *Lasioptera*. Forty-three cases in all, on some seventy different plants, have been reported, and a list of these is given.

The nature and extent of the mycelia in the fly-galls differ widely, and it is evident that various species of fungi (*Macrophoma* and other forms) are involved. The manner in which the fungus gains access to the galls is not fully known. Direct observations on oviposition have been made only in the case of *Mikiola fagi*, in which the eggs are laid in early spring on the outside of the leaf buds or on the shoot stems. The resulting larvae penetrate the interior of the buds and the leaf primordia, producing the familiar conical galls. Probably the process is similar in the other cases under consideration. The larva presumably comes into contact with the conidia of various fungi, which adhere to its moist body and are thus carried passively to the place at which the gall formation begins.

Normally the fungus lives in the gall as a harmless saprophyte without injuring the larva. In exceptional cases, however, the latter may be smothered by an excessive growth of the mycelium. As soon as the larva vacates the gall, or if it dies from any cause, the fungus may become parasitic on the cells of the gall tissues, which usually begin to decay under such circumstances.

Neger's view that there is a symbiosis between the insect and the fungus is controverted by the author. The fungus no doubt benefits by the abundant food supply resulting from the effects of stimulation by the larva of the plant tissues. But it confers no corresponding benefits on the larva, and the relations between the two may even become definitely hostile.

FULMEK (L.) & STIFT (A.). **Ueber im Jahre 1920 erschienene bemerkenswerte Mitteilungen auf dem Gebiete der tierischen und pflanzlichen Feinde der Kartoffelpflanze.** [Noteworthy contributions published during 1920 to the study of insect and vegetable pests of the Potato.]—*Centralblatt für Bakt.*, Abs. 2, Lief. 20–24, pp. 492–529, 1921.

A summary of the work on potato diseases, especially in Central Europe, during 1920, with bibliographical references. A section is devoted to leaf roll, mosaic, and other diseases, the origin of which is obscure. Wart disease and scab are treated at considerable length.

WILSON (M.). **Armillaria mellea as a Potato disease.**—*Trans. Royal Scottish Arbor. Soc.*, xxxv, pp. 186–187, 1921.

The honey Agaric, *Armillaria mellea*, well known as a disease of conifers and broad-leaved trees, has not hitherto been recorded as attacking potatoes in Great Britain, but only in Japan, Australia, and N. America. Specimens have, however, recently been submitted for examination from Rosebery, Midlothian. The dark brown rhizomorphs of the fungus are at once apparent on examination. As usual they present the form of rounded, brown strands, becoming slightly flattened on coming into contact with the tuber. Penetration generally occurs rapidly, and this is shown by a darker coloured, sunken patch on the skin, below which the cells are killed and partially disorganized. Sections through the tubers reveal either small patches of dead, brown cells, or large cavities, according to the depth of penetration of the rhizomorphs. In the latter case the cavities become partially filled up with masses of white mycelium and rhizomorphs. These cavities are surrounded by a dark brown zone of dead tuber-tissue, and this in its turn by a region where the hyphae can be seen penetrating the still living cells. A cork cambium is formed round the diseased portions, the infected cells being more or less isolated by a layer of cork. In severe cases the tubers shrivel and dry up in storage.

An examination of the garden in which the potatoes were grown revealed large numbers of rhizomorphs in the soil, but no fructifications. The source from which the rhizomorphs were developed was found to be an old sycamore stump, severely infected by *A. mellea*, and situated about four yards from the edge of the potato plot. The heavy wet soil of the garden may be a contributory factor in the development of the disease, which has occurred for several years and cannot, therefore, be due to seasonal peculiarities.

MANN (H. H.), NAGPURKAR (S. D.), KULKARNI (G. S.), KASARGODE (R. S.), PARANJPYE (S. R.), & JOSHI (B. M.). **Investigations on Potato cultivation in Western India.**—*Dept. of Agric., Bombay, Bull.* 102, 145 pp., 9 pl., 1921.

This bulletin is a discussion of the various phases of potato cultivation, including insect pests and diseases, in the Bombay Presidency, India.

Under the title 'The ring disease of potato' (pp. 38–57) Mann and Nagpurkar report that the ring or 'bangdi' disease is probably the worst potato disease. It is caused by *Bacillus solanacearum*. The

disease is carried by the seed, and after having been grown a few years in India most of the tubers of a stock of potatoes will carry it. New stock is usually obtained from Italy, and is generally, but not always entirely, free from the bacteria. The organism appears to die in the soil within six months. The bacteria are very virulent and may be spread with the knife used for cutting tubers. The results of a number of experiments are given.

'Other diseases found in the seed' (pp. 57–75) are discussed by Nagpurkar and Kulkarni. Tuber rots caused by *Fusarium* spp. cause much loss in storage. Affected tubers were found to germinate more quickly than sound tubers, but the crop produced is more likely to show rot. The soil also carries the *Fusaria*, but appears to lose its infectiveness after eight months dry weather without crop. *Fusarium* wilt also occurs in the Deccan area, and the brown ring in the tubers has sometimes been confused with the bacterial ring disease mentioned above. *Rhizoctonia* also appears to cause some damage. *Spongospora subterranea* was found in the hilly districts, and a limited attack of nematodes in various places.

Under 'the storage of potatoes' (pp. 84–97) Mann and Nagpurkar report that 'black heart' or 'heat rot' is common in storage in India because of the high temperatures, and recommend sorting the tubers, storing them under conditions which allow air circulation, and the maintenance of as cool conditions as possible.

Mann and Joshi report 'A chemical study of "heat rot" or "black heart" of potato' (pp. 112–142). They find that at temperatures above 30° C., especially in the absence of aeration, there is a considerable increase in the ammoniacal nitrogen in the tubers and an increase in the amount of gummy matter and dextrin in the potato juice. In air the sugars increase at high temperatures, but this increase is slight when respiration is prevented. Acidity or alkalinity of the juice is not materially affected in cases of black heart. Lessened respiration occurs as black heart develops, and the amount of catalase is reduced in affected tubers.

Goss (R. W.). **Temperature and humidity studies of some Fusaria rots of the Irish Potato.**—*Journ. Agric. Res.*, xxii, 2, pp. 65–80, 2 pl., 1921.

The author tested the ability of *Fusarium oxysporum F. trichothecioides*, and *F. radicicola* to rot potato tubers under different conditions of temperature and humidity. The three species make about the same growth in pure culture at 25° C., and this temperature is favourable for the production of tuber rot by each species. *F. oxysporum* and *F. radicicola* increase in growth rate in culture up to 30°, whereas *F. trichothecioides* decreases in rate of growth above 25° C., and also produces a tuber rot at lower temperature than the other two species, causing a rot in some cases at 5° C. At temperatures of 16° and above *F. oxysporum* produces more extensive rot than the other species used. Old tubers rot more readily than new tubers from the three *Fusaria*.

With all three species the greater the relative humidity the greater the rot at any temperature; in fact, the rotting was always greater under conditions of high humidity at a given temperature than at a temperature 5° to 10° higher but with a low humidity.

The use of dry as well as cool storage is therefore important in reducing the loss from *Fusarium* rots of potatoes.

PATCH (EDITH M.). **Rose bushes in relation to Potato culture.**—*Maine Agric. Exper. Sta., Orono, Bull.* 303, pp. 321–344, 1 fig., 1921.

The pink and green potato aphid (*Macrosiphum solanifolii*) is known to be one of the most important factors in the dissemination of potato mosaic and leaf roll, and in 1921 the author was sent to Aroostook Farm, Presque-Isle, in northern Maine, for the purpose of studying its probable field relation to the spread of these diseases. Among other facts she established that, under Maine conditions, the rose is the only existing primary host of the insect, i. e. the only plant species on which it deposits its overwintering eggs, and on which develops the spring generation of stem-mothers, as she never found the first two spring generations developing on any other host than rose bushes. Although native wild roses are of very rare occurrence in northern Maine, there are large numbers of uncultivated escapes especially in old house yards and in neighbouring hedgerows, where the hardy wild stocks on which the more tender cultivated varieties had been grafted have survived. In one particular case, about 2,000 such rose stems were observed in two old yards within easy reach of Aroostook Farm.

In relation to the bearing of the presence of rose bushes on the spread of mosaic, it was found in general that the nearer the rose, the heavier the infestation of the potato plants, and this was so marked in certain localities that the site of the rose bushes could be traced by following a line of increasing infestation of the potato fields. In a series of fields at graduated distances from rose bushes infested with the spring forms of the aphid, the migrants and their summer progeny were found to be colonizing potato fields that were within a few rods, earlier than fields a quarter of a mile distant, while fields half a mile away were so much later in becoming infested that the indication was that such fields would suffer very slightly in comparison with those nearer the roses; it follows, therefore, that even so short a distance as a quarter of a mile may sometimes be great enough to make all the difference between a heavy and a slight attack of aphids.

The writer's conclusion is that the evidence would seem to be that the rose 'is a pernicious weed with reference to potato culture', and that it should not be tolerated at distances under one mile from commercial seed potato fields. The situation in regard to table potatoes is not so serious, and the expense and trouble involved in destroying the roses might not always be justifiable. Valuable or ornamental bushes that it is desired to preserve should be treated so as to prevent their infestation by aphids, preferably by fumigation.

KASAI (MIKIO). **Observations and experiments on the leaf-roll disease of the Irish Potato in Japan.**—*Berichte d. Ohara-Inst. f. Landwirtsch. Forsch.*, ii, 1, pp. 47–77, 1922.

Leaf roll of potatoes, which had been recorded previously for

Japan in papers in Japanese, was found to be serious in the Okayama prefecture. The author gives a review of the literature, and records a number of preliminary experiments made. These tests indicated that the disease is not transmitted through the soil, but may be transmitted by tuber grafting, and evidently also by insects.

The following experiment is considered to demonstrate transmission of the disease by juice from diseased plants: Leaflets from a leaf-roll plant were macerated in a mortar with a little water, and the juice thus prepared was soaked up with bits of cotton and applied to knife wounds on petioles or stems of four plants. After a week two plants showed no symptoms of leaf roll, but on one plant inoculated at the middle height of the stem the leaves adjacent to the wound showed some discoloration and tendency to upward rolling in the tips of terminal leaflets, and in the other plant, inoculated on a petiole, decided discoloration and upward rolling appeared on the tip of the terminal leaflet of the leaf inoculated.

TICE (C.). **Seed Potato inspection and certification in British Columbia.**—*Scient. Agric.* [*Canada*], ii, 8, pp. 249-251, 1922.

Each province of Canada had a seed potato inspection service in 1921. The inspection and certification of potatoes in British Columbia was begun in 1921, and carried out by the Provincial Department of Agriculture. Two field and two tuber inspections were adopted, with the following standards: First field inspection (at about blossoming time). Only those fields are passed which show less than 5 per cent. mixture of varieties, 5 per cent. combined leaf roll, mosaic, and curly dwarf, 3 per cent. wilt, and 2 per cent. blackleg [*Bacillus atrosepticus*]. Roguing must be done through the summer by the grower, and at the second field inspection (in late summer) only 2 per cent. mixture and 2 per cent. combined leaf roll, mosaic, and curly dwarf are allowed. A field of potatoes lacking vigour is rejected, and notes are made in the field of the amount of late blight [*Phytophthora*], *Rhizoctonia*, and early blight [*Alternaria*] present.

The first tuber inspection is made before the crop is graded, with the objects of ascertaining whether the potatoes are sufficiently free from disease and true to type to warrant a certificate after grading, and of showing the grower how to grade. At this inspection the following are the limits of disease allowed: *Rhizoctonia*: 10 per cent. tubers with slight scurf, and 3 per cent. with severe scurf. Stem end discoloration: 3 per cent. Late blight or dry rots: 2 per cent. Powdery scab [*Spongospora*]: No severe, 1 per cent. slight. Common scab [*Actinomyces*]: No severe, 5 per cent. slight. Net necrosis: 5 per cent. Internal brown spot: 3 per cent. Silver scurf [*Spondylocladium*]: 5 per cent. Not more than 10 per cent. total infection by all the above tuber diseases is allowed.

The crop must then be graded; where only one grade is being put up, the tubers must not be smaller than 3 ounces nor larger than 12 ounces. A second grade of potatoes of 2 ounces or more is allowed for small seed stock. Crops passing all the above

standards are then given tags bearing name and address of grower, variety and size of seed, and date of final inspection; one such tag is attached and sealed to each sack of potatoes by the inspector at shipping time.

The 1921 inspections showed that leaf roll and mosaic exist in British Columbia, but apparently in limited amounts. The valuable features of seed potato certification are pointed out.

DUCOMET (V.). **Oïdium de la Pomme de terre et Oïdium de la Betterave.** [*Oidium* of the Potato and *Oidium* of Beetroot.]—*Bull. Soc. de Path. Vég. de France*, viii, 4, pp. 153–154, 1921.

The author, in a paper in the same *Bulletin*, vii, pp. 57–58, 1920, drew attention to an undetermined *Oidium* of the potato, observed in the Department of Lot-et-Garonne in 1917. Shortly afterwards the fungus was reported from Grignon, but no practical importance was attached to the disease. In 1921, however, it appeared with greater severity and has also been reported in the neighbourhood of Pontivy (Brittany) and at Vitry-sur-Seine. The fungus, in the affected areas in the Department of Lot-et-Garonne and at Grignon, commenced to invade the crop after the rains at the beginning of August had given a fresh stimulus to vegetation. The variety l'Industrie, as well as the English sorts, the Factor and Majestic, have proved extremely susceptible. Saucisse, though grown in the vicinity of l'Industrie, at first showed comparatively slight infection, but was virulently attacked later on. On the other hand, certain varieties, such as l'Institut de Beauvais, have remained apparently immune. It was noticed that copper solutions used in the treatment of blight appeared also to have the effect of checking the *Oidium*. Although the latter produced perithecia in 1921, the author has so far been unable to find matured asci. Hence it is still impossible to determine the species, though it is surmised that it may prove to be *Erysiphe cichoracearum* or an allied form. It is perhaps the same as *E. solani*, mentioned, but not described, by Vanha in 1902.

A second undetermined species of *Oidium* has been found on isolated plants of sugar beet at Grignon, and also observed by the author at Mormant (Seine-et-Marne). The damage caused was insignificant in both cases. As to the species concerned it is possibly *Microsphaera betae* Vanha (1902). The conidiophore characters indicate that it cannot be *Erysiphe polygoni*, which has been reported on this host from the Caucasus.

SCHOEVERS (T. A. C.). **Ziekten en Beschadigingen van Tomaten.** [Diseases and injuries of Tomatoes.]—*Tijdschr. over Plantenziekten*, xxviii, 5 and 6, pp. 67–93, 4 pl., 1922.

The observations of the writer and other officials of the Dutch Phytopathological Service, together with information collected from Dutch and foreign technical literature, are here presented in the form of a complete record of the tomato diseases known to occur in Holland. The fungous diseases described and illustrated are wilt (*Verticillium albo-atrum*), *Rhizoctonia* disease, canker (*Diplodina lycopersici* = *Didymella lycopersici*), *Sclerotium* disease (*Sclerotinia libertiana*), stripe (*Bacillus lathyri*), leaf mould and rust

(*Cladosporium fulvum*), potato blight (*Phytophthora infestans*), and nose rot (*Phytobacter lycopersicum*).

For *Verticillium* wilt there is a natural remedy in high temperatures (over 77° F.) to which the fungus is very susceptible. The glass should be lightly plastered and watered to prevent excessive evaporation, and the plants well banked up on the first symptoms of wilt. To prevent the reappearance of the disease in the following year, the remains of the infected plants, with the surrounding soil, must be carefully removed. The fungus can live on decaying organic refuse or on the remains of plants themselves, and overwinter there. Thus the soil easily becomes infected. In severe cases of soil infection the only radical cure is a renewal of the soil, care being taken not to procure the latter from potato fields, which are also likely to be infected. Steam treatment is efficacious for the disinfection of the soil, but not generally practicable in Holland. The use of cresol has not given satisfactory results in the destruction of soil fungi. A solution successfully applied to the soil in England consists of $5\frac{1}{2}$ parts of ammonium carbonate and 1 part of copper sulphate, using 3 gm. of the mixture per litre of water. During the winter the soil may be saturated with a 2·5 per cent. solution of formalin, using 20 litres of water per square metre. This should be done ten days or more before planting. In England the variety 'Manx Marvel' is stated to be resistant to wilt, but it does not appear to be cultivated in Holland.

The measures recommended for the control of *Verticillium* are equally applicable to *Rhizoctonia*. It is not known, however, whether it is affected by high or low temperature.

The spread of canker may be prevented by burying or burning the remains of diseased plants, on which the spores of the fungus develop in the spring. Spores may also adhere to the framework and glass of the greenhouses, and are possibly also present in the soil. As a remedial measure spraying with Bordeaux mixture is recommended. The plants and the atmosphere should be maintained as dry as possible in order to prevent germination of the spores.

Sclerotium disease is incurable when once the plant is actually attacked, but may be prevented from occurring the following year if the infected plants are burnt before the sclerotia fall to the ground.

Stripe disease is transmissible by the seed, and may be prevented by seed disinfection. The bacillus may also remain in the soil, which should be sterilized by means of steam. The disease is best controlled by such cultural methods as retarding growth and keeping the houses cool. Plentiful fertilization with potassium is also recommended, but an excess of nitrogenous manure favours the disease. Diseased plants should be removed, together with the surrounding soil. If only the upper part is infected, this may be cut away and the suckers allowed to develop. The variety Ailsa Craig appears to be resistant to stripe disease. The more rapid and luxuriant the growth of a variety the greater its susceptibility to *B. lathyri*.

Leaf mould may also be prevented by keeping the plants cool, and spraying the woodwork, glass, &c. in winter with a 10 per cent.

Carbolineum solution. Spraying with Californian (lime-sulphur) mixture in preference to Bordeaux is recommended as a remedial measure. In sunny weather the mixture is diluted with 60 parts of water, and when overcast with 40 parts. Whenever possible the treatment should be carried out during fine weather on account of the greater efficacy of the sulphur under such conditions. As a rule the disease appears towards the middle of July, and it is advisable to apply a preliminary spray about the first of the month and another a fortnight later.

Potato disease (*Phytophthora infestans*) can be prevented from attacking tomatoes by spraying with Bordeaux mixture. The amount of copper sulphate and also of lime should on no account exceed 0·75 to 1 per cent. Outdoor tomatoes are generally more liable to the disease than those under glass. The latter should be kept as dry as possible.

Nose rot (*Phytobacter lycopersicum*) attacks principally the tomatoes hanging lowest on the plant, the bacteria being present in the soil. They are spattered on to the fruits with particles of earth, and penetrate the skin through any crevice or wound, causing the formation of brown spots. The wounds may be so minute that they are only visible under a microscope. It is not certain whether infection can also occur through the style or the intact skin. The diseased fruits should be burnt or buried, and not simply left on the ground to form centres of infection. The soil should be thoroughly turned up, so that the upper infected layer comes well underneath. Sterilization by steam is also advisable.

In the concluding section, devoted to general sanitary measures, the use of river sand for seed-beds is recommended. Directions are also given for the disinfection of the soil, pots, and the like.

In addition to the diseases caused by fungi, notes are given on mosaic disease, on the chief insect pests, and also on such abnormalities as fasciation and leaf curl. Mosaic disease is less injurious to tomatoes than to tobacco and potatoes. Mosaic plants should not be used for seed, since a predisposition to the disease may be hereditary. The intensity of the disease may sometimes be reduced by whitewashing the glass of the houses.

CIFERRI (R.). **Una nuova malattia del Pomidoro: la carie.** [A new Tomato disease: caries.]—*Riv. di Patol. veg.*, xi, 5–6, pp. 65–69, 1921.

This is a preliminary account of a new tomato disease observed towards the end of June, 1921, in the environs of Alba, on an immature tomato fruit. The fruit was flaccid, soft, slightly discoloured, the skin being healthy except at one point where a brownish depression occurred. The pulp in the interior of the fruit was found to be rotted and almost black, the rotted area being divided from the exterior parenchyma, which had remained healthy and adhered to the skin, by a more or less well-defined, reddish zone. The rotted tissue bore numerous black pycnidia of a *Phoma* measuring about 0·2 mm. in diameter, and containing an abundance of elliptical or roundish, hyaline, continuous, apparently non-guttulate, small stylospores, 2·5 by 1·5 μ.

Inoculation experiments proved the pathogenicity of the fungus.

How infection occurs in nature is not yet known, but the subsequent invasion is very rapid, and under the most favourable conditions the whole of the pulp is rotted in five or six days, the fruit losing its form and becoming a putrid mass. The skin, however, remains unaltered, and generally also a small part of the adhering parenchyma which seems to be very resistant to the disease.

It is noteworthy that when the disease is not too far advanced, the maturation of affected green fruit is not only not interfered with but—at least in laboratory experiments *in vitro*—accelerated.

Alterations in fruit by a species of *Phoma* are rare compared with those produced in stems and leaves. The present fungus has some resemblance to *Phoma oleracea* Sacc., *Phyllosticta lycopersici* Peck, *Phoma euphrena* Sacc., and *Phoma crocophila* (Mont.) Sacc. (*Perisporium crocophilum* Mont.), but the differences are regarded as sufficient to distinguish it as a new species which is named *Phoma ferrarisii*, a preliminary Latin diagnosis being given.

This tomato rot is somewhat rare, very few examples having been found in a garden where apical rot of tomato, due to *Bacterium briosii* Pav., was comparatively frequent, and where a drying up of the leaves, probably of physiological origin, was also present.

A species of *Ramularia* is generally associated with, and may be a stage of, *P. ferrarisii*.

Denaiffe. **Mildiou des épinards.** [Mildew of spinach.]—*Journ. Soc. Nat. Hort. de France*, xxiii, pp. 38-39, 1922.

In October 1921 spinach at Carignan (Ardennes) was severely attacked by *Peronospora effusa*. The disease developed with astonishing rapidity, most of the outer leaves being partially discoloured after a few days, while isolated spots appeared on the heart-leaves. A powdery coating of lilac-grey colour was apparent on careful inspection on the under surface of the leaves.

The unprecedented intensity of the disease was probably due to abnormally high temperature. There was a general outbreak of diseases apparently caused by species of *Peronosporaceae* (but possibly by *Erysiphaceae*) at the same time on hosts which are usually immune in the autumn. The foliage of *Scorzonera*, purple clover, comfrey, &c., was literally coated with a floury powder.

Considerable losses were caused by the attack on spinach, the leaves of which were unfit for use. It is recommended that all affected leaves should be burnt and the planting of *Chenopodiaceae* in the affected places discontinued for one or two years.

Barrus (M. F.). **Bean anthracnose.**—*Cornell Univ. Agr. Exper. Sta. Memoir* xlii, pp. 97-215, 8 pl. (5 coloured), 11 figs., 1921.

The author gives a full account of the disease, its importance, symptoms, and control, together with a discussion of the fungus (*Colletotrichum lindemuthianum*).

The fungus was found to attack *Phaseolus vulgaris* and, to some extent, *P. lunatus*, *P. multiflorus*, *P. acutifolius* var. *latifolius*, and *P. aureus*, but did not attack certain other species of *Phaseolus* inoculated. Of species belonging to other genera, only *Vigna sinensis* and *Dolichos biflorus* were infected in tests made by the author. There are at least two strains or biologic forms of the

fungus, and certain varieties of bean are resistant to both these forms.

Coloured illustrations are given of the effect of the disease on the pods and seeds, and also of the symptoms of bacterial blight, *Rhizoctonia*, and rust on the pods. A bibliography of 170 titles is appended.

McRostie (G. P.). **Inheritance of disease resistance in the common Bean.**—*Journ. Amer. Soc. Agron.*, xiii, 1, pp. 15–32, 1921.

The investigations reported in this paper had for their objects the dual purpose of studying the method of inheritance of disease resistance, and of obtaining varieties of beans resistant to the three diseases: anthracnose (*Colletotrichum lindemuthianum*), mosaic, and root-rot (*Fusarium martii phaseoli*).

From the families previously reported as homozygous resistant to anthracnose a number of white-seeded strains have been isolated, some of them promising commercial types. Some of the selected types are also exhibiting resistance to mosaic. Most of the crosses made in connexion with the inheritance of susceptibility to both root-rot and mosaic were reciprocal crosses between the root-rot resistant Flat Marrow and the mosaic resistant Robust Pea bean. Both these strains are also resistant to the prevalent β strain of the anthracnose fungus. Some F_2 plants were also selected from reciprocal crosses between the Flat Marrow and the ordinary White Marrow, the latter being resistant to the α strain of the anthracnose fungus and tolerant to mosaic. From this combination of parents there is some chance of securing progeny resistant to all three diseases.

The investigations of the inheritance of resistance to *Colletotrichum lindemuthianum* indicate a single factor difference between resistance and susceptibility where only the α strain of the fungus is involved. Where both the α and β strains are concerned, a two-factor difference is shown and a 9·7 ratio in the F_2 obtained. In both cases resistance is dominant over susceptibility.

In the case of bean mosaic there is a partial dominance of susceptibility over resistance. To account for the inheritance of resistance and susceptibility a two-factor hypothesis is advanced and supported by the totals of the observed F_2 ratios between resistant and susceptible plants, and by the fact that about one-sixteenth of these F_2 plants were severely infected with mosaic and bred true for this character in the F_3.

In the case of root-rot susceptibility is dominant over resistance. A tentative two-factor hypothesis is advanced to explain this result. The fact that the susceptible plants were in the majority in the F_2 and that a large number of F_3 families from these plants did not breed true, unlike those derived from resistant F_2 plants, accords with this view.

Bud-rot in Coco-nut palms.—*Agric. Circular* [Dept. of Agric., Fiji], iii, 1, pp. 10–11, 1922.

By notification in the Royal Gazette No. 3 of 1922, p. 13, the disease of coco-nuts known as bud-rot is stated to exist in the Colony of Fiji, and orders are issued for the destruction and

disposal of coco-nut palms affected with this disease under Regulation 20a of the Regulations under section 6 of the Diseases of Plants Ordinance, 1913. Regulation 20a states that the Governor may, at the time he declares any disease, 'order that trees or plants affected with such disease shall be immediately destroyed and disposed of in such a manner as shall be directed by the Superintendent of Agriculture or by an Inspector authorized in writing by him for that purpose, and if such directions are not immediately carried out by the owner of such trees or plants, such trees or plants may be destroyed forthwith by such Inspector at the expense of the owner and disposed of in such manner as the Inspector shall think fit'.

MARLATT (C. L.). **Report of the Federal Horticultural Board, United States Department of Agriculture,** 22 pp., 1921.

This report includes a list of the current quarantine and other restriction orders controlling the import of plants into the United States, brought up to October 1, 1921.

Quarantine No. 3 prohibits the importation of the common or Irish potato from Newfoundland, the islands of St. Pierre and Miquelon, Great Britain, Germany, and Austria-Hungary, on account of the potato wart disease [*Synchytrium endobioticum*]. Potatoes may be admitted from other foreign countries under permit and in accordance with the provisions of the regulations issued under the order of December 22, 1913, bringing the entry of potatoes under restrictions on account of injurious potato diseases and insect pests. Importation of potatoes is now authorized from the following countries: Denmark, Cuba, Bermuda, and the Dominion of Canada.

Wart disease is now limited to comparatively small areas in the States of Pennsylvania, West Virginia, and Maryland. The aggregate of new infections covers an area of less than one hundred acres. The three invaded States are enforcing effective quarantine measures. Important progress has been made in the research carried out in co-operation with the Bureau of Plant Industry and involving the following investigations: The development of successful methods of soil sterilization by heat, chemicals, or other means; the testing of both American and imported varieties of potatoes for reaction to the disease and adaptability to the climates and soils of the infested and adjacent regions; the study of the character of immunity in inheritance and the production by breeding of new immune varieties; the determination of the effect of climate and soil conditions on the distribution and development of the disease; and a careful study of the life-history of the organism.

Very important results have been obtained from these investigations, notably in respect of the determination of immune varieties. The outcome of the work has largely banished the fear that the disease might follow as destructive a course in the United States as in parts of Europe, but it is pointed out that there is none the less a continued necessity for thorough survey work and the strictest administration of local quarantine regulations.

Quarantine No. 7, as amended, prohibits the importation from each and every country of Europe and Asia, from the Dominion of Canada, and from Newfoundland, of all five-leafed pines and all

species and varieties of the genera *Ribes* and *Grossularia* on account of the white pine blister rust [*Cronartium ribicola*].

Quarantine No. 15 prohibits the importation from all foreign countries of living canes of sugar-cane, or cuttings or parts thereof, on account of certain injurious insects and fungous diseases.

Quarantine No. 19 prohibits the importation from all foreign localities and countries of all citrus nursery stock including buds, scions, and seeds, on account of citrus canker [*Pseudomonas citri*] and other dangerous citrus diseases.

Quarantine No. 24, as amended, prohibits the importation from south-eastern Asia (including India, Siam, Indo-China, and China), the Malay Archipelago, Australia, New Zealand, Oceania, the Philippine Islands, Formosa, Japan, and adjacent islands, in the raw or unmanufactured state, of seed and all other portions of Indian corn or maize, and the closely-related plants including all species of Teosinte (*Euchlaena*), Job's Tears (*Coix*), *Polytoca*, *Chionachne* and *Sclerachne*, on account of the downy mildews [*Sclerospora* spp.] and *Physoderma* diseases of Indian corn, except that Indian corn or maize may be imported under permit and in compliance with the conditions prescribed in the regulations of the Secretary of Agriculture.

Quarantine No. 28 prohibits the importation from eastern and south-eastern Asia, the Malay Archipelago, the Philippine Islands, Oceania (except Australia, Tasmania, and New Zealand), Japan (including Formosa and other adjacent islands), and the Union of South Africa, of all species and varieties of citrus fruits, on account of the citrus canker, except that oranges of the mandarin class (including satsuma and tangerine varieties) may be imported under permit.

The canker disease of citrus fruit has been officially reported to the Board as occurring in Australia. It therefore seemed desirable to extend the existing quarantine to cover Australia, Tasmania, and New Zealand, but action has been deferred until certain additional information can be secured.

Quarantine No. 34 prohibits the importation for any purpose of any variety of bamboo seed, plants, or cuttings thereof capable of propagation, including all genera and species of the tribe Bambuseae from all foreign countries and localities, on account of dangerous plant diseases, including the bamboo smut (*Ustilago shiraiana*). This quarantine order does not apply to bamboo timber consisting of the mature dried culms or canes, or to any kind of article manufactured from bamboo, or to preserved bamboo shoots.

Quarantine No. 37, revised, with regulations, prohibits the importation of nursery stock and other plants and seeds from all foreign countries and localities, on account of certain injurious insects and fungous diseases, except as provided in the regulations. The following plants and plant products may be imported without restriction: Fruit, vegetables, cereals, and other plant products imported for medicinal, food, or manufacturing purposes; and field, vegetable, and flower seeds. The entry of the following plants is allowed under permit: Lily bulbs, lily of the valley, narcissus, hyacinths, tulips, and crocus; stocks, cuttings, scions, and buds of fruits; rose stocks, including manetti, multiflora, brier rose, and *Rosa rugosa*; nuts, including palm seeds; seeds of fruit, forest,

ornamental, and shade trees; seeds of deciduous and evergreen ornamental shrubs; and seeds of hardy perennial plants.

Provision is also made for the issue of special permits under safeguards for the entry in limited quantities of nursery stock and other plants and seeds not covered in the preceding lists, for the purpose of keeping the country supplied with new varieties and necessary propagation stock.

[In a separate explanatory leaflet (H. B. 105, revised 1st January 1922), it is stated that nursery stock, &c., imported for propagation has been the source of 90 per cent. of the insect pests and plant diseases introduced from other countries, which occasion an annual loss to agriculture and forestry of about one billion dollars. A seven years' test of the possibility of safeguarding plant imports by inspection and disinfection has revealed the inadequacy of this method, and the necessity for excluding all plant stock not absolutely essential to the agricultural and silvicultural requirements of the United States. The procedure for obtaining special permits is described. The immediate sale of the imported plants is not permitted, but plants produced from them may be sold. The permits will chiefly be granted to commercial firms and scientific institutions. Importation must be made through the Federal Horticultural Board at Washington or San Francisco. Importation by mail through the Board is also permitted.]

Quarantine No. 39 prohibits the importation of seed or paddy rice from Australia, India, Japan, Italy, France, Germany, Belgium, Great Britain, Ireland, and Brazil on account of two dangerous plant diseases known as flag-smut (*Urocystis tritici*) and take-all (*Ophiobolus graminis*). Wheat, oats, barley, and rye may be imported from the countries named only under permit.

Quarantine No. 44 prohibits the importation of stocks, cuttings, scions, and buds of fruits from Asia, Japan, the Philippine Islands, and Oceania (including Australia and New Zealand) on account of dangerous plant diseases, including Japanese apple cankers, blister blight, and rusts, and injurious insect pests. Provision is made for the importation under special permit of limited quantities of stocks, cuttings, scions, and buds of fruits from the countries named, for propagation.

Legislazione fitopatologica. [Phytopathological legislation.]—*Boll. mensile della R. Staz. di Patologia vegetale*, iii, 1–3, pp. 25–26, 1922.

By circular dated 9th February 1922, the Italian Ministry of Agriculture authorized the importation into Italy, for the purpose of freeing from *Cuscuta* and re-exportation, of foreign pasture seeds, by responsible commercial firms, under special licences to be granted by the Regional Phytopathological Observatories [Stations]. In the applications for such licences, the country of origin of the seeds to be imported, the quantity and quality of the seed, and the place in which grading and freeing from *Cuscuta* will take place must be stated; guarantees must also be provided for the fulfilment of a number of conditions to which the importation is subjected, such as destruction of the refuse remaining after freeing from *Cuscuta*, re-exportation of the seed treated, supervision by the Phytopathological Stations, &c.